

LAKE STATES FOREST EXPERIMENT STATION^{1/}

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Preparation of this report was facilitated by workers supplied by the Works Progress Administration and the Civilian Conservation Corps.

Economic Notes No. 10

March 1938

FOREST AREAS AND TIMBER VOLUMES

IN THE LAKE STATES

A Progress Report on the
FOREST SURVEY OF THE LAKE STATES

By

R. N. Cunningham and H. C. Moser

LAKE STATES FOREST EXPERIMENT STATION
University Farm, St. Paul, Minnesota

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

LOCATION OF ECONOMIC UNITS

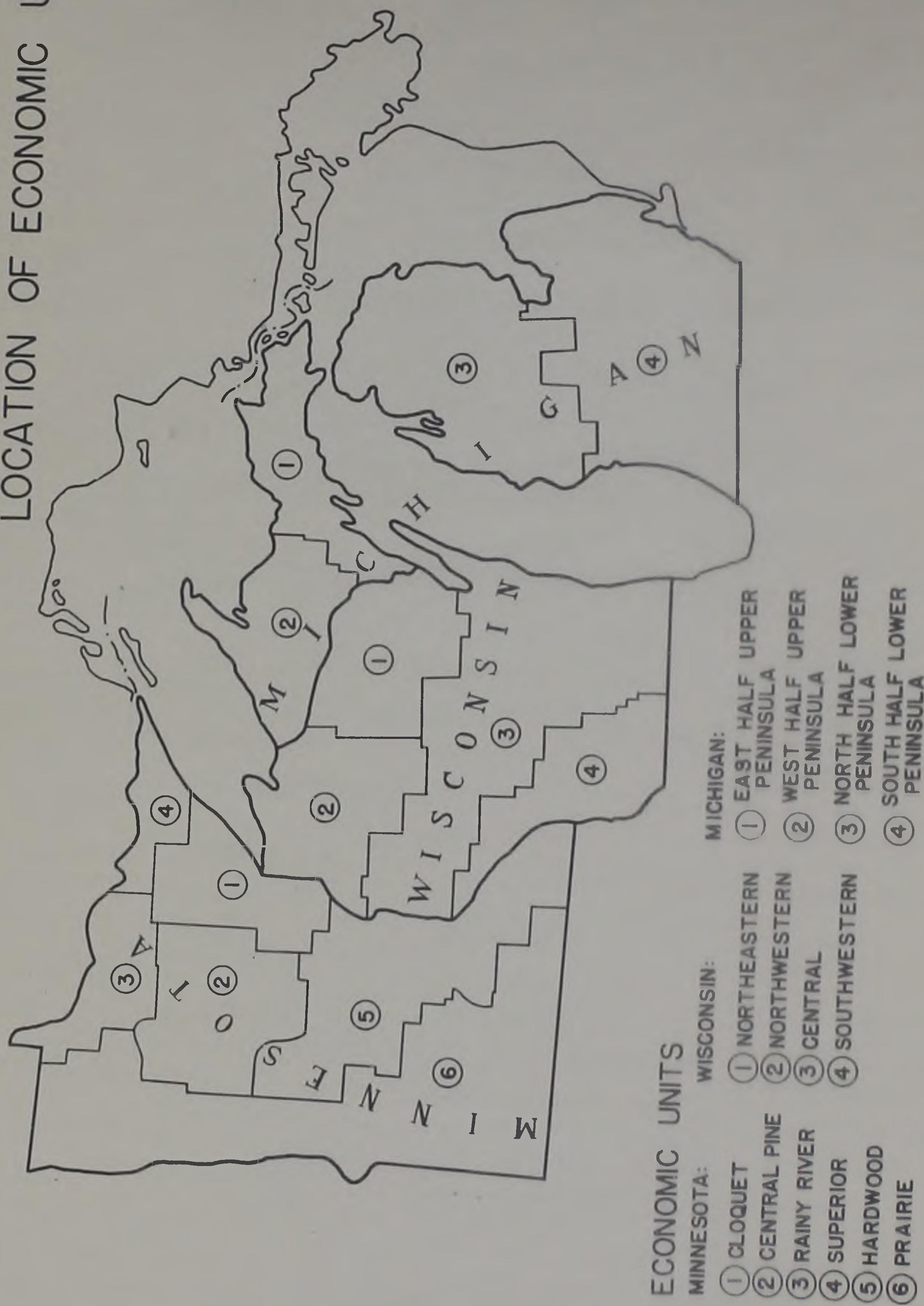


Figure 1

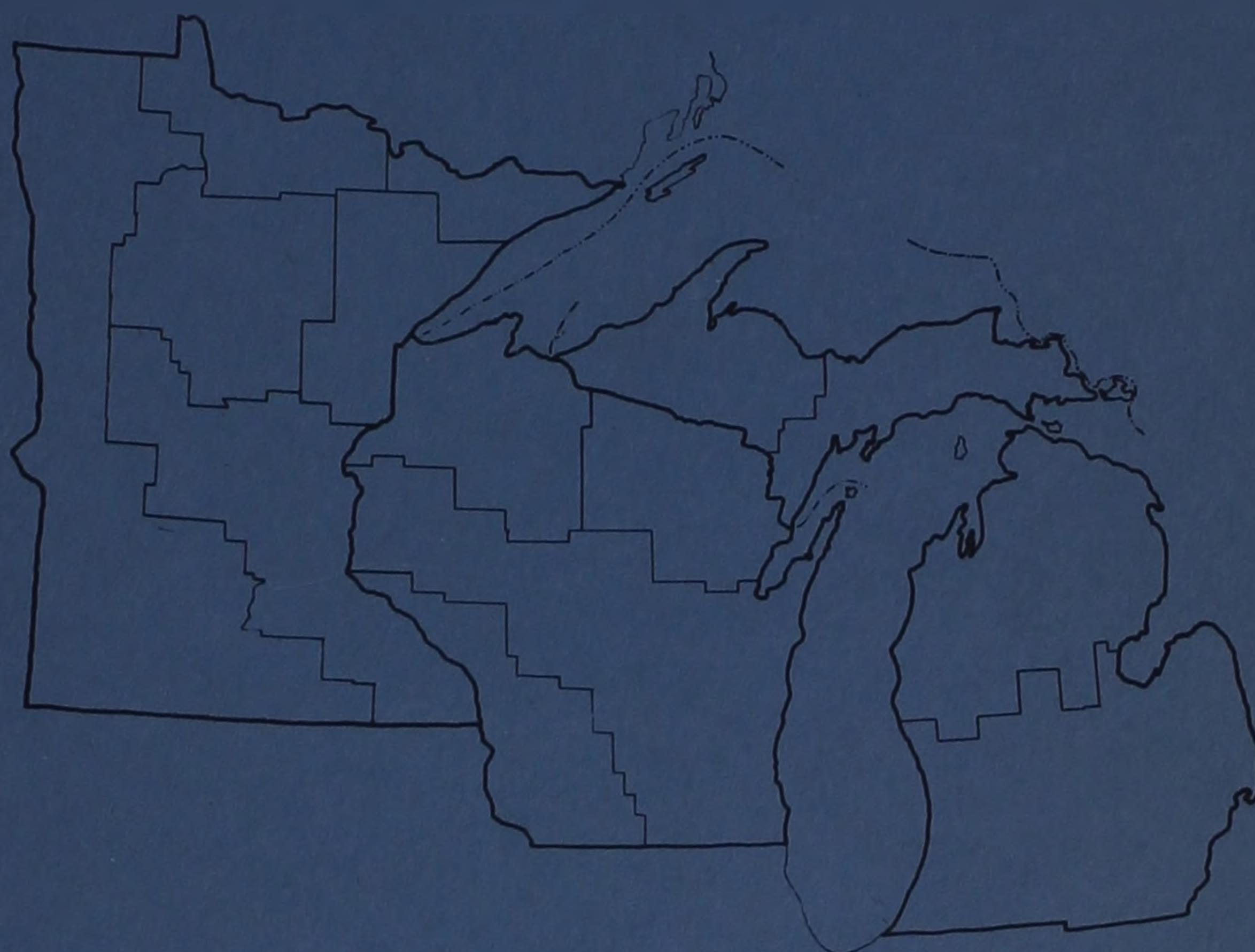
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FOREST AREAS AND TIMBER VOLUMES IN THE LAKE STATES



PRELIMINARY STATISTICS AND ANALYSIS OF DATA OBTAINED FROM
FOREST SURVEYS AND OTHER ECONOMIC STUDIES BY THE

LAKE STATES FOREST EXPERIMENT STATION
UNIVERSITY FARM - ST. PAUL MINNESOTA

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

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FOREST AREAS AND TIMBER VOLUMES

IN THE LAKE STATES

DISCUSSION

The inventory phase of the Forest Survey^{1/} of the Lake States -- Michigan, Minnesota, and Wisconsin -- has been completed, and preliminary statistics obtained through it are summarized in the tables presented in this report. The full significance of these forest-area and timber-volume figures can be determined only after compilation and analysis of statistics on forest-products requirements, timber growth, and forest depletion -- factors which are now engaging the attention of the Survey staff. These tables do, however, bring out a number of very significant points.

^{1/} The Forest Survey is a Nation-wide project authorized by Act of Congress (the McNary-McSweeney Forest Research Act) in 1928. The purpose is to obtain reliable statistics of forest area, timber volumes, growth, rate of depletion, and trends in timber consumption and requirements as a basis for determination of national policies. The inventory of forest areas and timber volumes in the Lake States is based upon a survey in which lines were run 10 miles apart throughout the forested areas of the three States and sample plots were taken at 1/8-mile intervals along each line. More than 120,000 plots were measured. This is the first complete field inventory of forest resources attempted in the Lake States.

The growing stock in the Lake States is badly depleted. There is too little mature timber, too little advanced second growth, to insure sustained production of high-grade wood in the near future.

There is, however, a large volume of wood of inferior quality and inferior species available for immediate use if the necessary processes and markets can be developed.

Nature has done a better job than many people suppose in restoring a cover on cut-over lands. The outlook for the more distant future is not nearly so black as it has usually been painted, provided there are continued improvements in fire protection and measures are taken to safeguard the young stands from premature cutting and other forms of abuse.

The major immediate forest problem of the Lake States is how to handle the remaining merchantable timber so as to tide over industries until second-growth forests develop to suitable size for cutting.

In general, the tables and charts speak for themselves. Attention will be called, however, to some of their outstanding indications; also, as a basis for orientation, attention will be called to

points on which the present statistics differ from earlier estimates^{2/} or on which the new data seem to contradict views commonly held.

The figures on forest area will be useful chiefly in considering the long-run possibilities of the Lake States forests; the volume figures will be used chiefly in figuring prospects for industries in the near future.

Before using data from this release, it is suggested that the reader familiarize himself with the several bases of classification and the standards of estimate used in the field work of the Forest Survey. These are described in some detail in the section following the tables. The methods followed in carrying on the survey are described in Economic Notes No. 4, released in May, 1936.

Forest Areas

Table 1 shows that the pine, spruce, and hardwood forests which originally occupied about 80 percent of all land in the three States now cover only 55.6 million acres, or 45.4 percent of

^{2/} The most recent of the previous estimates is the one made by the U.S. Forest Service in 1931, which served as the basis of the "Copeland Report." The 1931 figures were based upon maps and rough reconnaissance data.

the land. Forest acreage now totals 7 percent less than was estimated in 1931, the difference probably being due to inadequacy of the earlier figures.

The present forest acreage in the Lake States is almost identical with the productive forest area of Sweden and also with that of Finland. Swedish forests, however, occupy 56.5 percent of the national total land area, and those of Finland 67.2 percent. Forest lands average about 5.4 acres per capita in the Lake States, as compared with 9.39 acres in Sweden and 15.81 acres in Finland.^{3/}

Timber large enough to make sawlogs, as is shown in table 2, occupies 7 million acres, or 40 percent more than the 1931 estimate. There is 85 percent more pine saw timber than was previously listed. Cordwood acreage, also, is 20 percent greater. The shrinkage comes mainly in the total for the aspen type, which has been reduced 5 million acres below the 1931 estimate. However, aspen (with paper birch) is still the leading individual type, with 16-2/3 million acres, or 30 percent of the total forest area. The change in the aspen-type appraisal, which involves an increase of nearly 250 percent in saw-timber acreage and one of nearly 200 percent in cordwood acreage over 1931 figures, and greatly reduces

^{3/} Ilvessalo, Yrjo. A Comparison of the Forest Resources of the Northern Countries. Helsinki, 1931.

the acreage of restocking land, may merely reflect the inadequacy of earlier statistics but may indicate a gradual development in the condition of aspen-type stands.

The deforested acreage is greater than was estimated in 1931 -- 11-1/4 million acres as compared with 7 million. It is much less, however, than the figure given in the Capper Report in 1919 -- 20-1/2 million acres.

Acreage of deforested land is sometimes spoken of as synonymous with acreage needing planting. Some details which will qualify this assumption are given in tables 19 and 20. About 22 percent of the 11-1/4 million deforested acres consists of pastured lands on farms where, under existing plans of farm management, forest plantations would have little chance of success. Another 5.7 million acres of wild land, covered with dense brush or marsh grasses, would be very difficult to reforest. Level, easily plantable land totals only about 3 million acres.

On the other hand, half of the 26-1/2 million acres of restocking lands have been classified as of poor density (table 4). Doubtless many of these would require underplanting to become fully productive forests.

Tables 5 to 20, inclusive, give details concerning forest areas for each of the States, and for economic units within the

States. These will be of value mainly to those interested in particular local conditions. They bring out important differences between the States and between the farm-woods districts and the less accessible northern forests. The economic unit with the greatest acreage of uncut saw timber embraces the western half of the Upper Peninsula of Michigan. The northern half of the Lower Peninsula has the greatest acreage of deforested land.

In the distribution of forest areas as to size class of stand technical foresters will recognize evidences of an unbalanced growing stock -- an excess of very young timber with a corresponding shortage of stands of merchantable or near-merchantable size. This is most pronounced in the economic units closest to the consuming centers.

Saw-Timber Volume

The volume of standing saw timber shown in table 23 is 60 percent greater than estimates which were in use until the completion of this survey. The estimate for hemlock has been doubled, that for yellow birch increased 150 percent, those for jack pine and white pine about 170 percent, and that for aspen over 360 percent. The older estimates for maple and oak proved to be fairly close.

While these increases are encouraging, it must be recognized that present volumes are indeed a small fraction of the stands originally found in the Lake States and are considerably below what would be considered a desirable growing stock. The original stand of pine in the Lake States has been estimated at 300 to 350 billion board feet, or about 40 times the volume now remaining. No reliable estimate has been made of the original volume of hemlock and hardwood, but it is not unlikely that the total exceeded 100 billion feet, about 3 times the present volume.

There are certain indications, also, that the present stands are inferior in quality to the original forests. As regards species there is no absolute basis of comparison, but it is certain that there was a much smaller proportion of jack pine in the original pine forests. The new hardwood estimates show a greater proportion of such species as aspen, red maple, black ash, and elm than was shown by the estimates of 25 years ago.

As regards size of trees, table 25 shows that 28 percent of the saw-timber volume is in trees not more than 13 inches in diameter. Only 41.6 billion board feet of saw timber is in trees above this diameter. In Minnesota, 45 percent of the volume is in the small-sized timber.

Table 26 brings out another limiting factor: one-fifth of the saw-timber volume occurs on cordwood or restocking areas. By referring to table 34, it will be seen that the average cordwood acre supports a saw-timber volume of only 671 board feet, and an average restocking acre has only 111 board feet. Obviously, such a sparse stand does not present a very favorable logging chance. Even the typical second-growth saw-timber stand has a relatively low merchantable volume -- not quite 4 thousand board feet per acre.

Table 32 gives a clue to the average quality of the hardwood saw timber in each of the States. For the region as a whole, only 22 percent of the volume falls into the class of veneer logs and high-grade sawlogs and 30 percent falls into the No. 3 grade, the lowest quality acceptable in the lumber industry and one which in periods of low prices may be left in the woods.

Tables 37 to 56, inclusive, give details for States and subdivisions.

Pulpwood Volume

Table 27 shows that the region contains 128,586,000 cords of wood 4 inches or more in diameter in the common pulping species. Exclusive of sawlogs, wood suitable for high-grade pulpwood totals 39,440,000 cords (table 28).

In comparison with the 1931 estimates the figure for spruce is down 15 percent, the reduction being heaviest in Wisconsin. Wisconsin, which has the largest pulp industry of the three States, now has only 7 percent of the spruce pulpwood volume. The jack pine pulpwood estimate has been reduced 47 percent, the loss being heaviest in Michigan. The aspen pulpwood estimate has been raised 29 percent, the balsam fir 52 percent, and the hemlock nearly eight-fold. The tamarack total is little changed.

It must be understood, of course, that not all the volume classified as pulpwood is available for immediate conversion into pulp. A part must be retained as growing stock to provide future saw timber.

Cedar Products

The number of cedar poles and posts as shown in table 30 is much larger than is commonly supposed. However, the small extent and inaccessibility of certain stands place limits on their availability for immediate use.

Total Cubic Volume

The total cubic volume shown in table 31 is roughly half the volume found in Sweden in the survey which was made there a few years ago. The acreage of forest in Sweden is almost identical with that in the three Lake States combined. The per-acre volume in Sweden is about 847 cubic feet, in the Lake States 464 cubic feet (table 34). The standards of measurement are not identical, but are sufficiently close for comparative purposes. Finland's forests, likewise, average about 837 cubic feet per acre. The forests of Norway, occupying more rugged land, average but 589 cubic feet per acre. Thus the forest growing stock in the Lake States is low in comparison with that in northwestern Europe.

On a per-capita basis, there is only about one-fourth as much standing volume in the Lake States as in Sweden and only about one-sixth as much as in Finland.

Table 1. -- Area of forest land in the Lake States Region, by State and unit

State and unit	Gross land area ^{1/}	Area in forest	
		Acres	Percent
Minnesota	Acres	Acres	Percent
	5,369,400	4,329,900	80.64
	7,206,000	5,284,900	73.34
	4,141,100	3,808,400	91.97
	2,101,300	2,030,700	96.64
	11,356,300	2,318,300	20.41
	20,851,900	1,843,200	8.84
Total.....	51,026,000	19,615,400	38.44
Wisconsin	Acres	Acres	Percent
	5,750,000	4,567,000	79.43
	6,933,000	5,683,000	81.97
	16,475,000	4,869,000	29.55
	5,969,000	1,827,000	30.61
Total.....	35,127,000	16,946,000	48.24
Michigan	Acres	Acres	Percent
	5,000,000	4,350,000	87.00
	5,571,000	4,986,000	89.50
	10,774,000	7,441,000	69.06
	15,055,000	2,296,000	15.25
Total.....	36,400,000	19,073,000	52.40
Regional total.....	122,553,000	55,634,400	45.40

1/ Data obtained from surveys of the United States General Land Office.

Table 2. -- Area of forest land in the Lake States Region, by forest cover type and size class

Forest cover type 1/	Size class of stand				
	All sizes	Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	Acres	Acres	Acres	Acres	Acres
White pine.....	619,700	231,000	107,200	188,300	93,200
Red pine.....	339,500	43,600	75,200	134,700	86,000
Jack pine.....	2,706,000	4,400	322,100	929,800	1,449,700
Spruce-fir.....	3,147,300	76,000	328,700	1,186,300	1,556,300
Spruce swamp...	2,332,800	3,000	44,900	818,100	1,466,800
Tamarack swamp.	1,106,900	3,000	16,300	241,500	846,100
Cedar swamp....	1,220,600	21,600	87,300	415,100	696,600
Nonproductive swamp.....	836,100	.....	.....	6,400	829,700
Northern hard-woods.....	8,214,600	2,579,100	1,190,300	1,277,600	3,167,600
Oak.....	3,519,000	303,800	559,300	1,232,300	1,423,600
Ash-elm.....	1,973,100	222,300	292,300	732,700	725,800
Aspen-birch....	16,671,800	49,300	506,800	3,251,500	12,864,200
Scrub forest...	1,702,900	49,000	7,000	422,600	1,224,300
Deforested.....	11,244,100				
All forest types.....	55,634,400	3,586,100	3,537,400	10,836,900	26,429,900
Shelterbelts 2/	86,300	1,300	14,400	50,600	20,000

1/ Scrub oak forest in the northern half of the Lower Peninsula of Michigan is included with the oak type.

2/ Includes shelterbelts in prairie region of Minnesota only. Data excluded from regional total because of noncommercial character of shelterbelts.

FOREST LAND BY COVER TYPES
AND SIZE CLASSES
LAKE STATES REGION

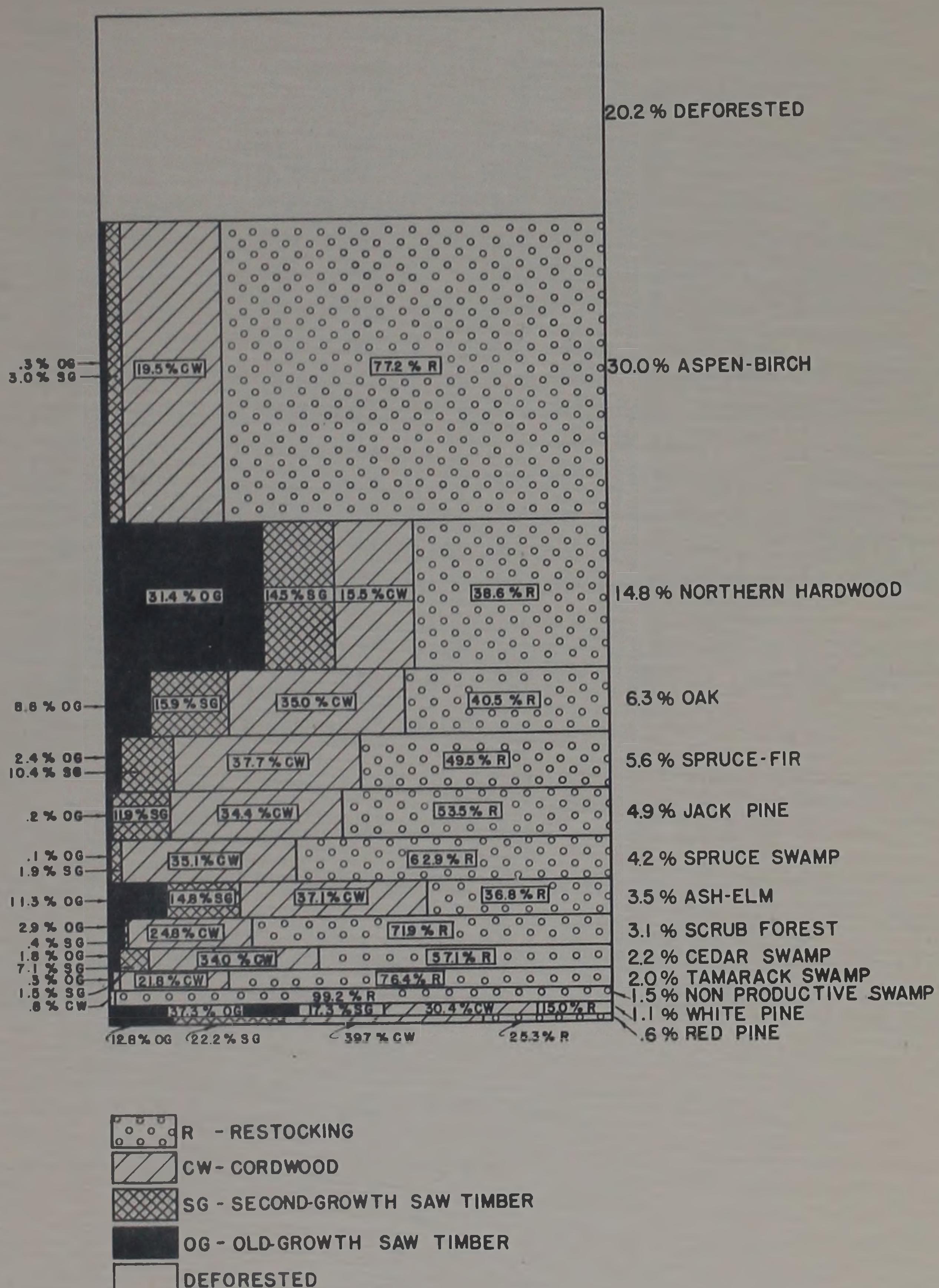


Figure 2

Table 3. -- Area of forest land in the Lake States Region, by forest cover type and State

Forest cover type	Region	Minnesota	Wisconsin	Michigan
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
White pine.....	619,700	233,700	215,000	171,000
Red pine.....	339,500	170,500	86,000	83,000
Jack pine.....	2,706,000	1,266,000	665,000	775,000
Spruce-fir.....	3,147,300	1,088,300	638,000	1,421,000
Spruce swamp.....	2,332,800	1,529,800	325,000	478,000
Tamarack swamp.....	1,106,900	656,900	203,000	247,000
Cedar swamp.....	1,220,600	380,600	201,000	639,000
Nonproductive swamp..	836,100	763,100	50,000	23,000
Northern hardwoods...	8,214,600	893,600	2,745,000	4,576,000
Oak.....	3,519,000	476,000	1,736,000	1/ 1,307,000
Ash-elm.....	1,973,100	616,100	674,000	683,000
Aspen-birch.....	16,671,800	6,309,800	5,317,000	5,045,000
Scrub forest.....	1,702,900	1,107,900	552,000	1/ 43,000
Deforested.....	11,244,100	4,123,100	3,539,000	3,582,000
All forest types.....	55,634,400	19,615,400	16,946,000	19,073,000
<u>Shelterbelts</u> ^{2/}	86,300	86,300		

1/ Scrub oak forest in the northern half of the Lower Peninsula is included with the oak type.

2/ Includes shelterbelts in prairie region of Minnesota only. Data excluded from regional total because of noncommercial character of shelterbelts.

ble 4. -- Density of cover on restocking lands in the Lake States Region,
by forest cover type and State

Forest cover type	Percentage of area in indicated density class											
	Region			Minnesota			Wisconsin			Michigan		
	G	M	P	G	M	P	G	M	P	G	M	P
black pine...	13.5	28.4	58.1	18.5	29.1	52.4	17.3	32.3	50.4	7.8	25.0	67.2
red pine...	17.0	22.9	60.1	33.1	22.3	44.6	7.4	37.0	55.6	10.3	10.4	79.3
white pine.	17.2	31.7	51.1	33.3	16.9	49.8	9.5	40.5	50.0	17.8	28.6	53.6
oak.....	17.3	23.8	58.9	5.2	31.6	63.2	30.3	25.1	44.6	9.8	22.1	68.1
scrub oak..	11.6	28.1	60.3	1.4	22.8	75.8	17.1	31.4	51.5	3.3	16.7	80.0
aspen.....	17.3	31.5	51.2	16.9	32.5	50.6	20.6	34.8	44.6	14.0	27.0	59.0
balsam fir.	21.7	29.4	48.9	14.5	30.0	55.5	14.0	33.6	52.4	30.2	26.6	43.2
northern												
hardwoods.	29.8	28.9	41.3	8.9	29.2	61.9	27.8	33.6	38.6	35.1	25.9	39.0
pruce.....	24.8	37.8	37.4	24.6	38.0	37.4	26.9	43.3	29.8	23.4	32.6	44.0
amarack...	28.6	27.8	43.6	31.4	26.8	41.8	24.9	30.4	44.7	24.7	28.0	47.3
edar.....	41.6	29.0	29.4	23.5	37.9	38.6	54.7	23.6	21.7	45.3	26.9	27.8
nonproductive												
swamp	32.7	38.7	28.6	34.6	39.9	25.5	22.0	30.0	48.0	8.7	26.1	65.2
bottomland												
hardwoods.	10.9	23.5	65.6	9.4	24.3	66.3	10.5	28.3	61.2	13.6	17.1	69.3
all forest												
types.....	20.4	30.4	49.2	18.8	32.2	49.0	21.9	33.5	44.6	20.5	26.1	53.4

G = Good density -- 700 or more trees per acre, well distributed.
M = Medium density -- 400 to 700 trees per acre, well distributed.
P = Poor density -- 100 to 400 trees per acre, well distributed.

Table 5. -- Area of all forest cover types in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class				Deforested land
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land	
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota						
1.....	4,329,900	23,600	135,200	575,800	2,454,400	1,140,900
2.....	5,284,900	66,600	373,000	1,132,500	2,822,000	890,800
3.....	3,808,400	80,800	189,400	851,500	1,791,500	895,200
4.....	2,030,700	33,600	303,900	938,700	675,300	79,200
5.....	2,318,300	104,100	160,200	679,500	683,900	690,600
6.....	1,843,200	34,400	61,700	380,900	939,800	426,400
Total.	19,615,400	343,100	1,223,400	4,558,900	9,366,900	4,123,100
Wisconsin						
1.....	4,567,000	355,000	231,000	634,000	2,575,000	772,000
2.....	5,683,000	240,000	217,000	1,015,000	3,206,000	1,005,000
3.....	4,869,000	393,000	357,000	832,000	2,027,000	1,260,000
4.....	1,827,000	257,000	356,000	393,000	319,000	502,000
Total.	16,946,000	1,245,000	1,161,000	2,874,000	8,127,000	3,539,000
Michigan						
1.....	4,350,000	565,000	251,000	875,000	2,059,000	600,000
2.....	4,986,000	1,093,000	503,000	852,000	1,934,000	604,000
3.....	7,441,000	88,000	162,000	1,256,000	4,356,000	1,579,000
4.....	2,296,000	252,000	237,000	421,000	587,000	799,000
Total.	19,073,000	1,998,000	1,153,000	3,404,000	8,936,000	3,582,000
Regional total....	55,634,400	3,586,100	3,537,400	10,836,900	26,429,900	11,244,100
<u>Shelterbelts 1/</u>	86,300	1,300	14,400	50,600	20,000	.....

1/ Includes shelterbelts in prairie region of Minnesota only. Data excluded from regional total because of noncommercial character of shelterbelts.

Table 6. -- Area of white pine type in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	15,700	2,400	1/	7,800	5,500
2.....	62,100	30,300	12,300	11,700	7,800
3.....	49,300	38,900	1/	9,600	800
4.....	97,800	33,600	1/	61,000	3,200
5.....	7,200	800	800	800	4,800
6.....	1,600	.....	100	400	1,100
Total.....	233,700	106,000	13,200	91,300	23,200
Wisconsin:					
1.....	82,000	25,000	24,000	13,000	20,000
2.....	55,000	14,000	8,000	20,000	13,000
3.....	73,000	34,000	19,000	11,000	9,000
4.....	5,000	1,000	3,000	1,000	.....
Total.....	215,000	74,000	54,000	45,000	42,000
Michigan:					
1.....	45,000	15,000	6,000	14,000	10,000
2.....	75,000	28,000	22,000	18,000	7,000
3.....	40,000	7,000	8,000	15,000	10,000
4.....	11,000	1,000	4,000	5,000	1,000
Total.....	171,000	51,000	40,000	52,000	28,000
Regional total...	619,700	231,000	107,200	188,300	93,200

1/ Small acreage included with old-growth saw timber.

Table 7. -- Area of red pine type in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	16,400	800	.....	11,700	3,900
2.....	90,100	13,900	20,100	37,800	18,300
3.....	37,100	12,100	9,700	12,100	3,200
4.....	17,800	1	2,600	13,500	1,700
5.....	7,200	800	1,600	2,400	2,400
6.....	1,900	.....	200	1,200	500
Total.....	170,500	27,600	34,200	78,700	30,000
Wisconsin:					
1.....	49,000	7,000	14,000	9,000	19,000
2.....	23,000	1,000	6,000	12,000	4,000
3.....	11,000	2,000	3,000	2,000	4,000
4.....	8,000	.....	1,000	2,000	.....
Total.....	86,000	10,000	24,000	25,000	27,000
Michigan:					
1.....	37,000	2,000	5,000	20,000	10,000
2.....	13,000	1,000	6,000	4,000	2,000
3.....	33,000	3,000	6,000	7,000	17,000
4.....	.....	.....	.....	.....	.....
Total.....	83,000	6,000	17,000	31,000	29,000
Regional total..	339,500	43,600	75,200	134,700	96,000

^{1/} Included with second-growth saw timber.

Table 8. -- Area of jack pine type in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	121,500	.....	19,700	61,100	40,700
2.....	480,800	2,400	59,400	200,400	218,600
3.....	100,400	.....	14,600	61,600	24,200
4.....	554,800	.....	184,500	196,100	174,200
5.....	6,400	.....	1,600	2,400	2,400
6.....	2,100	.....	300	1,200	600
Total.....	1,266,000	2,400	280,100	522,800	460,700
Wisconsin:					
1.....	83,000	1,000	7,000	21,000	54,000
2.....	264,000	.....	10,000	77,000	177,000
3.....	299,000	1,000	8,000	93,000	197,000
4.....	19,000	.....	.....	7,000	12,000
Total.....	665,000	2,000	25,000	198,000	440,000
Michigan:					
1.....	190,000	.....	.....	48,000	142,000
2.....	43,000	.....	2,000	13,000	28,000
3.....	530,000	.....	15,000	144,000	371,000
4.....	12,000	.....	.....	4,000	8,000
Total.....	775,000	.....	17,000	209,000	549,000
Regional total.	2,706,000	4,400	322,100	929,800	1,449,700

Table 9. -- Area of spruce-fir type in the Lake States Region, by States, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	426,100	6,300	33,800	149,800	235,200
2.....	243,900	6,900	44,000	116,600	76,400
3.....	295,600	10,500	44,500	141,100	99,500
4.....	108,700	.....	7,100	81,400	20,200
5.....	4,000	.....	800	1,600	1,600
6.....	10,000	300	1,500	4,800	3,400
Total.....	1,088,300	24,000	131,700	495,300	437,300
Wisconsin:					
1.....	299,000	2,000	6,000	85,000	206,000
2.....	296,000	1,000	12,000	113,000	170,000
3.....	43,000	.....	2,000	16,000	25,000
Total.....	638,000	3,000	20,000	214,000	401,000
Michigan:					
1.....	623,000	15,000	55,000	242,000	311,000
2.....	512,000	33,000	112,000	162,000	205,000
3.....	285,000	1,000	10,000	73,000	201,000
4.....	1,000	.....	.....	.....	1,000
Total.....	1,421,000	49,000	177,000	477,000	718,000
Regional total	3,147,300	76,000	328,700	1,186,300	1,556,300

Table 10. -- Area of northern hardwood type^{1/} in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	82,500	10,200	14,200	13,300	44,800
2.....	302,300	6,100	64,900	56,400	174,900
3.....	14,400	1,600	3,200	3,200	6,400
4.....	2,200	.....	1,900	200	100
5.....	393,500	70,500	74,500	140,300	108,200
6.....	98,700	17,700	18,600	35,200	27,200
Total.....	893,600	106,100	177,300	248,600	361,600
Wisconsin:					
1.....	975,000	297,000	122,000	95,000	461,000
2.....	968,000	206,000	139,000	164,000	459,000
3.....	588,000	186,000	146,000	123,000	133,000
4.....	214,000	82,000	49,000	38,000	45,000
Total.....	2,745,000	771,000	456,000	420,000	1,098,000
Michigan:					
1.....	1,121,000	504,000	110,000	96,000	411,000
2.....	2,101,000	1,006,000	258,000	218,000	619,000
3.....	987,000	68,000	95,000	209,000	615,000
4.....	367,000	124,000	94,000	86,000	63,000
Total.....	4,576,000	1,702,000	557,000	609,000	1,708,000
Regional total..	8,214,600	2,579,100	1,190,300	1,277,600	3,167,600

^{1/} Including oak in upper Michigan and ash-elm in Minnesota, Unit 4.

Table 11. -- Area of oak type^{1/} in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	5,600	.....	800	.....	4,800
2.....	37,400	2,300	3,100	11,600	20,400
3.....	.....	.....	.....	.....	.....
4.....	.....	.....	.....	.....	.....
5.....	274,000	16,800	49,700	156,300	51,200
6.....	159,000	9,700	28,700	90,400	30,200
Total,.....	476,000	28,800	82,300	258,300	106,600
Wisconsin:					
1.....	97,000	5,000	4,000	11,000	77,000
2.....	84,000	4,000	3,000	19,000	58,000
3.....	707,000	84,000	111,000	277,000	235,000
4.....	848,000	121,000	274,000	298,000	155,000
Total,.....	1,736,000	214,000	392,000	605,000	525,000
Michigan:					
1.....	.....	.....	.....	.....	.....
2.....	.....	.....	.....	.....	.....
3.....	872,000	1,000	2,000	229,000	640,000
4.....	435,000	60,000	83,000	140,000	152,000
Total,.....	1,307,000	61,000	85,000	369,000	792,000
Regional total,.	3,519,000	303,800	559,300	1,232,300	1,423,600

^{1/} Including scrub oak in Michigan unit 3. Oak in upper Michigan is included not here but with northern hardwoods, in table 10.

Table 12. -- Area of ash-elm type¹ in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	116,900	800	10,200	27,500	78,400
2.....	199,300	800	29,400	71,800	97,300
3.....	73,700	5,600	8,900	26,700	32,500
4.....	.....	.....	.....	.....	.....
5.....	153,000	13,600	21,600	50,500	67,300
6.....	73,200	6,500	10,200	24,200	32,300
Total.....	616,100	27,300	80,300	200,700	307,800
Wisconsin:					
1.....	124,000	11,000	27,000	46,000	40,000
2.....	185,000	10,000	19,000	72,000	84,000
3.....	288,000	60,000	50,000	106,000	72,000
4.....	77,000	21,000	9,000	24,000	23,000
Total.....	674,000	102,000	105,000	248,000	219,000
Michigan:					
1.....	87,000	9,000	10,000	31,000	37,000
2.....	113,000	14,000	29,000	37,000	33,000
3.....	187,000	7,000	15,000	95,000	70,000
4.....	296,000	63,000	53,000	121,000	59,000
Total.....	683,000	93,000	107,000	284,000	199,000
Regional total..	1,973,100	222,300	292,300	732,700	725,800

¹ Ash-elm type in Minnesota Unit 4 included with northern hardwoods, in table 10.

Table 13. -- Area of spruce swamp type in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	353,300	.....	1,600	44,000	307,700
2.....	221,500	.....		67,200	154,300
3.....	468,200	.....	9,700	260,000	198,500
4.....	439,400	.....	6,800	222,400	210,200
5.....	7,200	.....		3,200	4,000
6.....	40,200	.....	800	22,300	17,100
Total.....	1,529,800	.....	18,900	619,100	891,800
Wisconsin:					
1.....	168,000	.....		29,000	139,000
2.....	139,000	.....		24,000	115,000
3.....	18,000	.....		4,000	14,000
Total.....	325,000	.....		57,000	268,000
Michigan:					
1.....	202,000	1,000	8,000	60,000	133,000
2.....	227,000	2,000	18,000	72,000	135,000
3.....	48,000	.....		10,000	38,000
4.....	1,000	.....			1,000
Total.....	478,000	3,000	26,000	142,000	307,000
Regional total..	2,332,800	3,000	44,900	818,100	1,466,800

Table 14. -- Area of tamarack swamp type in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	107,600	.....	.....	14,200	93,400
2.....	166,000	.....	3,100	37,000	125,900
3.....	306,300	.....	5,700	66,500	234,100
4.....	.....	.....	.....	.....	.....
5.....	52,800	.....	.....	21,600	31,200
6.....	24,200	.....	500	5,200	18,500
Total.....	656,900	.....	9,300	144,500	503,100
Wisconsin:					
1.....	81,000	.....	.....	12,000	69,000
2.....	63,000	.....	.....	7,000	56,000
3.....	58,000	3,000	1,000	19,000	35,000
4.....	1,000	.....	.....	.....	1,000
Total.....	203,000	3,000	1,000	38,000	161,000
Michigan:					
1.....	130,000	.....	5,000	39,000	86,000
2.....	43,000	.....	1,000	7,000	35,000
3.....	53,000	.....	.....	5,000	48,000
4.....	21,000	.....	.....	8,000	13,000
Total.....	247,000	.....	6,000	59,000	182,000
Regional total..	1,106,900	3,000	16,300	241,500	846,100

Table 15. -- Area of cedar swamp type in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	Acres	Acres	Acres	Acres	Acres
Minnesota:					
1.....	81,500	.....	800	38,400	42,300
2.....	76,400	.....	4,600	27,000	44,800
3.....	177,400	2,400	8,900	89,900	76,200
4.....	29,500	.....	3,200	22,800	3,500
5.....	.....	.....	.....	.....	.....
6.....	15,800	200	800	8,000	6,800
Total.....	380,600	2,600	18,300	186,100	173,600
Wisconsin:					
1.....	103,000	3,000	10,000	35,000	55,000
2.....	46,000	.....	4,000	27,000	15,000
3.....	52,000	.....	1,000	15,000	36,000
Total.....	201,000	3,000	15,000	77,000	106,000
Michigan:					
1.....	293,000	10,000	17,000	90,000	176,000
2.....	153,000	6,000	36,000	31,000	80,000
3.....	180,000	.....	1,000	29,000	150,000
4.....	13,000	.....	.....	2,000	11,000
Total.....	639,000	16,000	54,000	152,000	417,000
Regional total...	1,220,600	21,600	87,300	415,100	696,600

Table 16. -- Area of Nonproductive swamp type¹ in the Lake States Region, BY State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	192,300	.....	.....	.....	192,300
2.....	76,400	.....	.....	1,500	74,900
3.....	318,300	.....	.....	3,200	315,100
4.....	14,700	.....	.....	.....	14,700
5.....	800	.....	.....	.....	800
6.....	160,600	.....	.....	1,700	158,900
Total.....	763,100	.....	.....	6,400	756,700
Wisconsin:					
1.....	41,000	.....	.....	.....	41,000
2.....	9,000	.....	.....	.....	9,000
3.....	.....	.....	.....	.....	.....
4.....	.....	.....	.....	.....	.....
Total.....	50,000	.....	.....	.....	50,000
Michigan:					
1.....	6,000	.....	.....	.....	6,000
2.....	14,000	.....	.....	.....	14,000
3.....	3,000	.....	.....	.....	3,000
4.....	.....	.....	.....	.....	.....
Total.....	23,000	.....	.....	.....	23,000
Regional total...	836,100	.....	.....	6,400	829,700

¹/Area of deforested swamp is shown in table 20.

Table 17. -- Area of aspen-birch type in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	1,661,100	3,100	54,100	208,000	1,395,900
2.....	2,314,300	3,900	132,100	491,200	1,687,100
3.....	1,067,700	9,700	84,200	176,800	797,000
4.....	686,600	.....	97,800	341,300	247,500
5.....	383,500	1,600	9,600	62,400	309,900
6.....	196,600	.....	.....	35,800	160,800
Total.....	6,309,800	18,300	377,800	1,315,500	4,598,200
Wisconsin:					
1.....	1,674,000	4,000	17,000	278,000	1,375,000
2.....	2,363,000	2,000	16,000	478,000	1,867,000
3.....	1,165,000	4,000	12,000	152,000	997,000
4.....	115,000	4,000	17,000	21,000	73,000
Total.....	5,317,000	14,000	62,000	929,000	4,312,000
Michigan:					
1.....	998,000	9,000	35,000	234,000	720,000
2.....	1,084,000	3,000	19,000	289,000	773,000
3.....	2,644,000	1,000	10,000	440,000	2,193,000
4.....	319,000	4,000	3,000	44,000	268,000
Total.....	5,045,000	17,000	67,000	1,007,000	3,954,000
Regional total.	16,671,800	49,300	506,800	3,251,500	12,864,200

Table 18. -- Area of scrub forest type¹ in the Lake States Region, by State, economic unit, and size class

State and economic unit	Total area	Area by size class ²			
		Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking land
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	8,500	.....	.....	.....	8,500
2.....	123,600	.....	.....	2,300	121,300
3.....	4,800	.....	.....	800	4,000
4.....	.....	.....	.....	.....	.....
5.....	338,100	.....	.....	238,000	100,100
6.....	632,900	.....	.....	150,500	482,400
Total.....	1,107,900	.....	.....	391,600	716,300
Wisconsin:					
1.....	19,000	.....	.....	.....	19,000
2.....	183,000	2,000	.....	2,000	179,000
3.....	307,000	19,000	4,000	14,000	270,000
4.....	43,000	28,000	3,000	2,000	10,000
Total.....	552,000	49,000	7,000	18,000	478,000
Michigan:					
1.....	18,000	.....	.....	1,000	17,000
2.....	4,000	.....	.....	1,000	3,000
3.....	.....	.....	.....	11,000	10,000
4.....	21,000	.....	.....	.....	.....
Total.....	43,000	.....	.....	13,000	30,000
Regional total...	1,702,900	49,000	7,000	422,600	1,224,300

¹/ Scrub oak forest in Michigan unit 3 included with oak type, in table 11.

²/ Small acreages of scrub forest in Minnesota and Michigan included with cordwood and restocking land.

Table 19. -- Area of deforested land in the Lake States Region, by State, economic unit, and character of cover

State and economic unit	Total area	Area of --		
		Grass ^{1/}	Brush and marsh ^{2/}	Lightly wooded pasture ^{3/}
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:				
1.....	1,140,900	163,100	977,800	.....
2.....	890,800	198,400	692,400	.....
3.....	895,200	128,800	766,400	.....
4/.....	79,200	.....	79,200	.....
5.....	690,600	43,200	239,600	407,800
6.....	426,400	53,700	214,700	158,000
Total.....	4,123,100	587,200	2,970,100	565,800
Wisconsin:				
1.....	772,000	262,000	410,000	100,000
2.....	1,005,000	255,000	550,000	200,000
3.....	1,260,000	191,000	360,000	709,000
4.....	502,000	88,000	54,000	360,000
Total.....	3,539,000	796,000	1,374,000	1,369,000
Michigan:				
1.....	600,000	295,000	260,000	45,000
2.....	604,000	217,000	363,000	24,000
3.....	1,579,000	1,003,000	432,000	144,000
4.....	799,000	196,000	305,000	298,000
Total.....	3,582,000	1,711,000	1,360,000	511,000
Regional total.....	11,244,100	3,094,200	5,704,100	2,445,800

^{1/} Includes bracken, sweet fern, and light brush.

^{2/} Brush so heavy as to make forest planting difficult. Deforested swamps included.

^{3/} Farm pastures with a few scattered trees.

^{4/} Grass land included with brush.

Table 20. -- Area of deforested land in the Lake States Region, by State, economic unit, and character of cover

State and economic unit	Total area	Area by former type			
		Pine	Swamp	Hardwood ^{1/}	Spruce-fir ^{2/}
	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
Minnesota:					
1.....	1,140,900	163,200	467,700	165,500	344,500
2.....	890,800	294,200	322,800	217,000	56,800
3.....	895,200	46,200	621,400	102,000	125,600
4.....	79,200	.....	.....	.....	79,200
5.....	690,600	44,900	76,900	568,800	.....
6.....	426,400	2,400	119,500	293,100	11,400
Total.....	4,123,100	550,900	1,608,300	1,346,400	617,500
Wisconsin:					
1.....	772,000	218,000	135,000	261,000	158,000
2.....	1,005,000	199,000	189,000	392,000	225,000
3.....	1,260,000	212,000	100,000	929,000	19,000
4.....	502,000	6,000	.....	496,000	.....
Total.....	3,539,000	635,000	424,000	2,078,000	402,000
Michigan:					
1.....	600,000	230,000	116,000	170,000	84,000
2.....	604,000	142,000	124,000	211,000	127,000
3.....	1,579,000	996,000	92,000	427,000	64,000
4.....	799,000	107,000	39,000	643,000	10,000
Total.....	3,582,000	1,475,000	371,000	1,451,000	285,000
Regional total.....	11,244,100	2,660,900	2,403,300	4,875,400	1,304,500

^{1/} Includes upland hardwood and swamp hardwood.

^{2/} All deforested land in Minnesota unit 4 was arbitrarily classified as spruce-fir.

Table 21. -- Summary of timber volume^{1/} in the Lake States Region, by product

Product	Volume of standing timber	Equivalent in thousand cubic feet of solid wood	
		Volume	Percent
Saw timber ^{2/} M ft.b.m.	57,615,740	9,520,990	32.5
Cordwood ^{3/} in:			
Small trees..... Cords....	122,286,000	8,804,200	30.0
Tops and limbs..... Cords....	70,394,000	4,223,490	14.4
Cull in sawlog trees. Cords....	30,289,000	1,992,980	6.8
All cordwood. Cords....	222,969,000	15,020,670	51.2
Cedar products:			
Poles..... Pieces....	41,518,000	407,130	1.4
Round posts..... Pieces....	224,774,000	348,850	1.2
Split posts..... Pieces....	99,715,000	164,850	0.6
Other cedar volume ^{4/} Cords....	5,256,000	346,920	1.2
All cedar products.....		1,260,750	4.4
All merchantable trees.....		25,809,410	88.1
Cull trees..... Cords....	52,166,000	3,494,830	11.9
All live trees.....		29,304,240	100.0

^{1/} Dead trees not included.

^{2/} International 1/4" kerf rule.

^{3/} Exclusive of cedar, and of cordwood cut from saw timber.

Small trees include scrub trees of large diameter unsuitable for sawlogs.

^{4/} "Other cedar volume" includes small cedar trees containing no piece products, and tops above piece products.

TOTAL VOLUME OF TIMBER LAKE STATES REGION

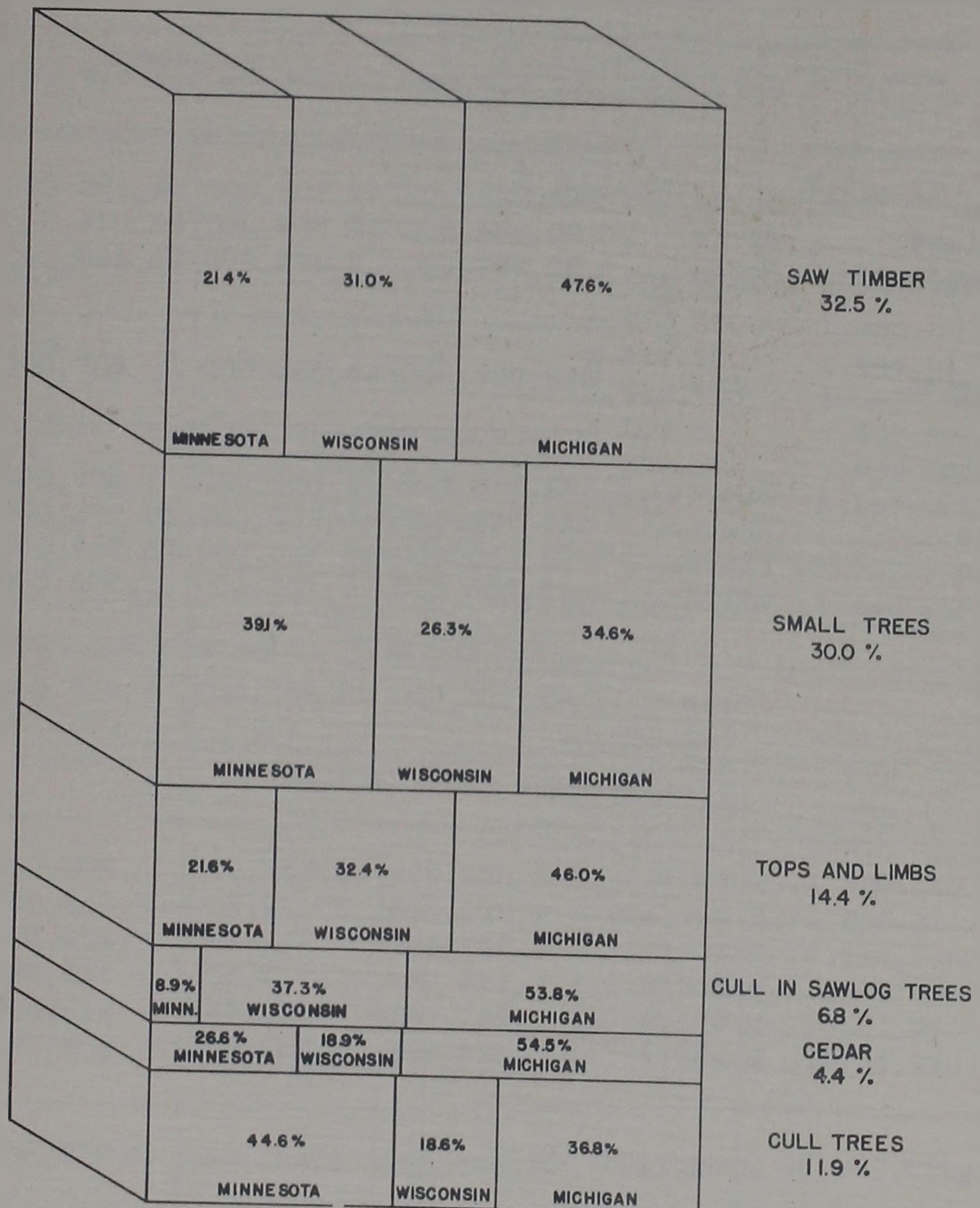


Figure 3

Table 22. -- Summary of timber volume^{1/} in the Lake States Region, by product and State

Product	Regional total	Minnesota	Wisconsin	Michigan
Saw timber ^{2/} M ft.b.m.	57,615,740	12,454,740	16,612,000	28,549,000
Cordwood ^{3/}				
Small trees..... Cords....	122,286,000	47,767,000	32,195,000	42,324,000
Tops and limbs..... Cords....	70,394,000	15,209,000	22,834,000	32,351,000
Cull in sawlog trees Cords....	30,289,000	2,372,000	11,428,000	16,489,000
All cordwood..... Cords....	222,969,000	65,348,000	66,457,000	91,164,000
Cedar products				
Poles..... Pieces...	41,518,000	11,059,000	7,589,000	22,870,000
Round posts..... Pieces...	224,774,000	61,953,000	49,174,000	113,647,000
Split posts..... Pieces...	99,715,000	15,318,000	25,959,000	58,438,000
Other ^{4/} Cords....	5,256,000	1,787,000	788,000	2,681,000
Cull trees..... Cords....	52,166,000	23,252,000	9,719,000	19,195,000

Equivalent Cubic Volume

Saw timber..... M cu.ft..	9,520,990	2,036,990	2,953,000	4,531,000
Small trees..... M cu.ft..	8,804,200	3,439,200	2,318,000	3,047,000
Tops and limbs..... M cu.ft..	4,223,490	912,490	1,370,000	1,941,000
Cull in sawlog trees.. M cu.ft..	1,992,980	177,980	743,000	1,072,000
Cedar..... M cu.ft..	1,267,750	336,750	240,000	691,000
Cull trees..... M cu.ft..	3,494,830	1,557,830	651,000	1,286,000
All products..... M cu.ft..	29,304,240	8,461,240	8,275,000	12,568,000

^{1/} Dead trees not included.

^{2/} International 1/4" kerf rule.

^{3/} Exclusive of cedar, and of cordwood cut from saw timber. Small trees include scrub trees of large diameter unsuitable for sawlogs.

^{4/} Includes small cedar trees containing no piece products, and tops above piece products.

Table 23. -- Volume of saw timber in the Lake States Region, by species, according to two log rules

Species	Saw-timber volume		Average overrun
	International rule, $\frac{1}{4}$ " kerf	Scribner rule	
	M bd. ft.	M bd. ft.	
Softwoods			
White pine	3,753,200	3,233,550	16.1
Red pine	1,478,380	1,226,800	20.5
Jack pine	2,677,790	2,244,920	19.3
Spruce	2,362,730	1,969,150	20.0
Balsam fir	1,089,310	901,370	20.9
Tamarack	297,340	239,800	24.0
Hemlock	9,222,000	8,162,000	13.0
All softwoods	20,880,750	17,977,590	16.1
Hardwoods			
Sugar maple	10,538,120	9,318,110	13.1
Yellow birch	5,252,230	4,646,610	13.0
Basswood	2,039,200	1,801,440	13.2
Elm	3,178,690	2,818,650	12.8
Beech	1,496,000	1,320,000	13.3
Oak ¹	5,297,790	4,635,320	14.3
Aspen	4,125,700	3,414,530	20.8
Paper birch	1,288,340	1,084,490	18.8
Soft maple	1,742,640	1,532,290	13.7
Miscellaneous hardwoods ²	1,776,280	1,526,440	16.4
All hardwoods	36,734,990	32,097,880	14.4
All species	57,615,740	50,075,470	15.1

¹/ Includes both red and white oak.

²/ Principally black ash, hickory, and hop-hornbeam.

Table 24. -- Volume of saw timber in the Lake States Region, by species and State, by International rule, 1/4" kerf

Species	Regional total	Minnesota	Wisconsin	Michigan
	M feet, b.m.	M feet, b.m.	M feet, b.m.	M feet, b.m.
Softwoods				
White pine.....	3,753,200	1,598,200	1,145,000	1,010,000
Red pine.....	1,478,380	998,380	293,000	187,000
Jack pine.....	2,677,790	2,262,790	246,000	169,000
Spruce.....	2,362,730	1,240,730	138,000	984,000
Balsam-fir.....	1,089,310	350,310	133,000	606,000
Tamarack.....	297,340	137,340	82,000	78,000
Hemlock.....	9,222,000	.....	2,672,000	6,550,000
All softwoods..	20,880,750	6,587,750	4,709,000	9,584,000
Hardwoods				
Sugar maple.....	10,538,120	306,120	2,809,000	7,423,000
Yellow birch.....	5,252,230	93,230	1,388,000	3,771,000
Basswood.....	2,039,200	451,200	828,000	760,000
Elm.....	3,178,690	701,690	1,229,000	1,248,000
Beech.....	1,496,000	.....	170,000	1,326,000
Oak ¹ /.....	5,297,790	761,790	3,325,000	1,211,000
Aspen ² /.....	4,125,700	2,366,700	804,000	955,000
Paper birch.....	1,288,340	783,340	160,000	345,000
Soft maple.....	1,742,640	110,640	435,000	1,197,000
Miscellaneous hardwoods ³ /.....	1,776,280	292,280	755,000	729,000
All hardwoods..	36,734,990	5,866,990	11,903,000	18,965,000
All species.....	57,615,740	12,454,740	16,612,000	28,549,000

¹/ Includes both red and white oak.

²/ Includes balsam poplar and cottonwood.

³/ Principally black ash, hickory, and hop-hornbeam.

SAW-TIMBER VOLUME IN THE LAKE STATES
MILLION BOARD FEET

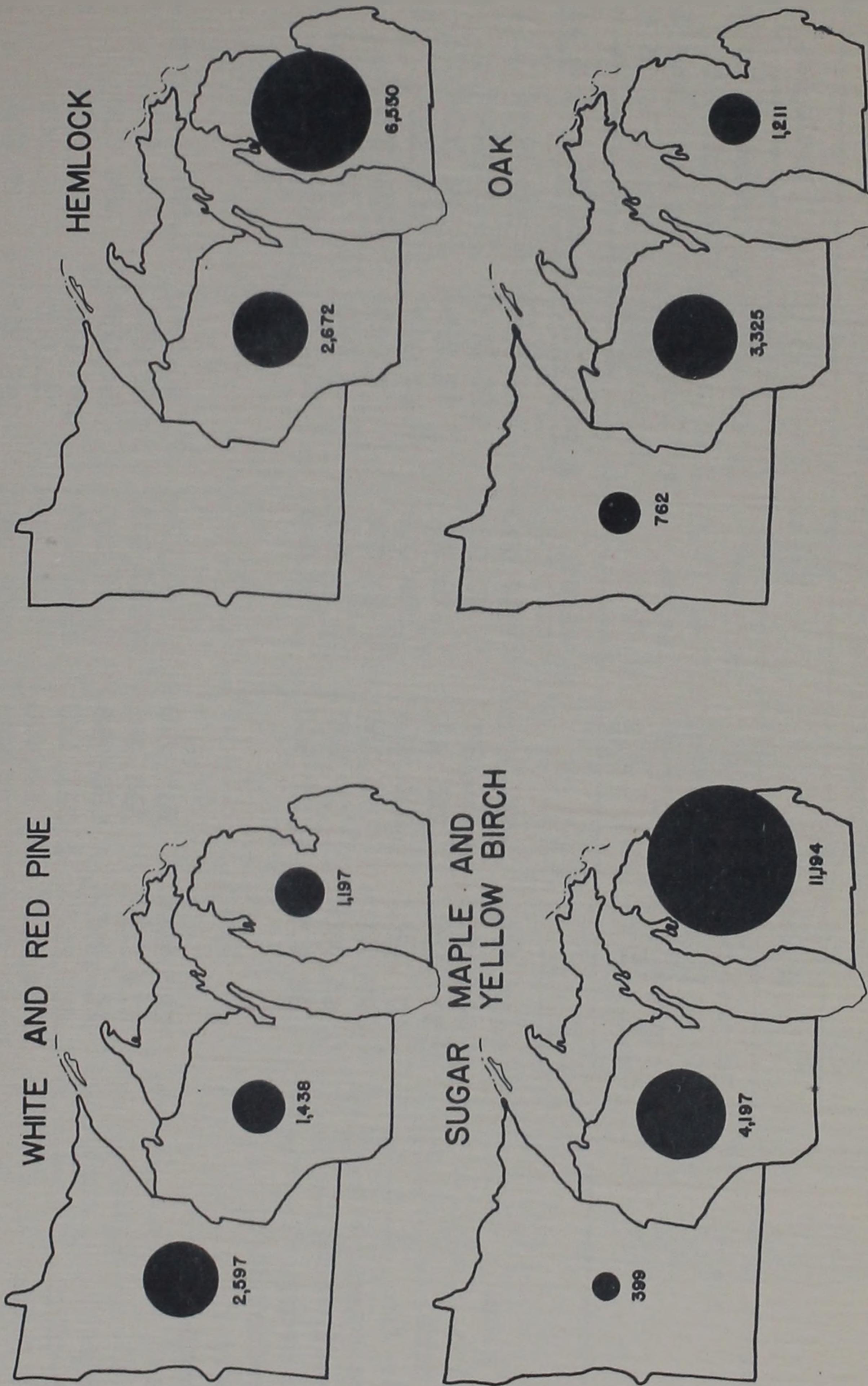


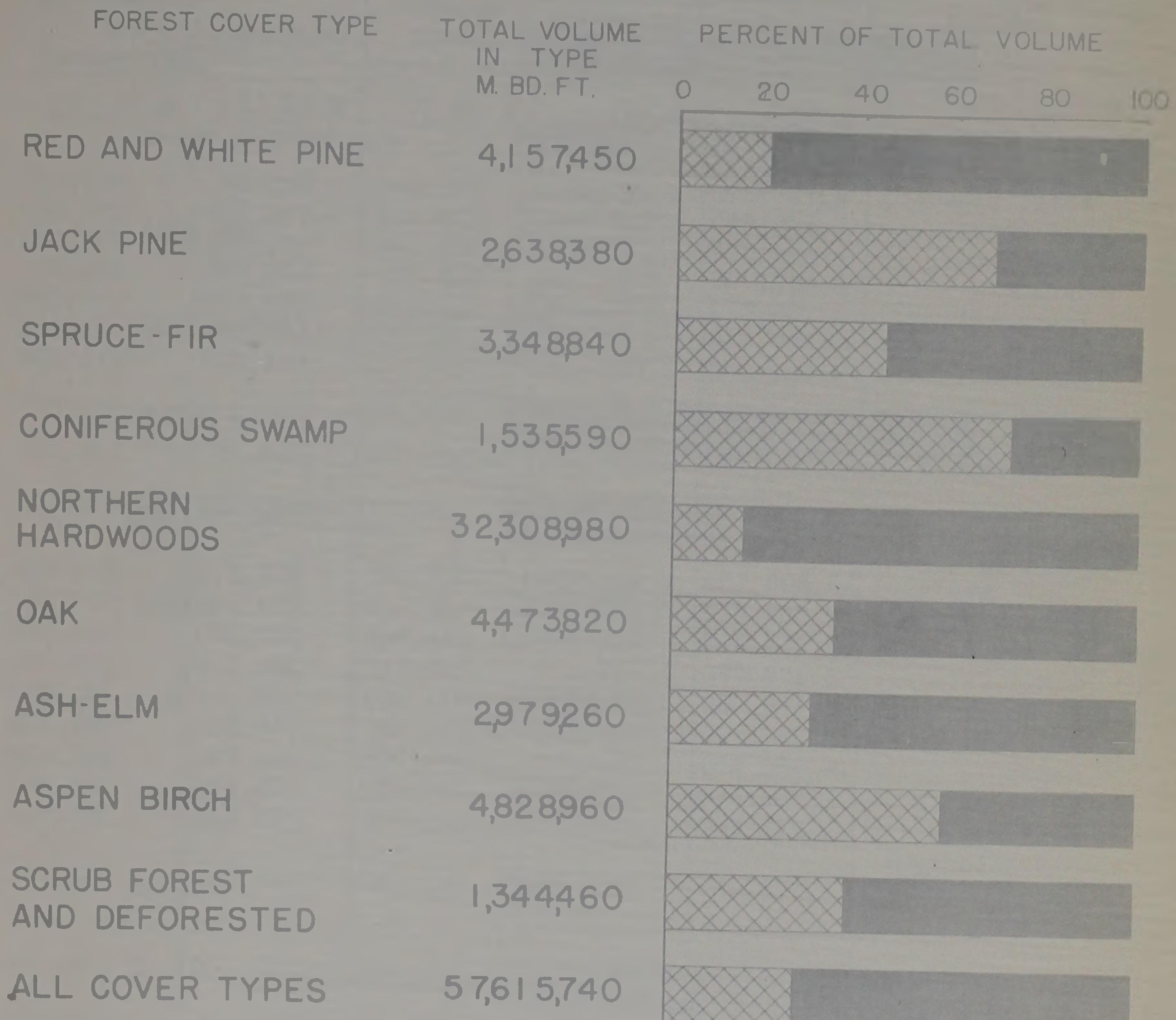
Figure 4

Table 25. -- Volume of saw timber in the Lake States Region, by forest cover type, State, and diameter group

Forest cover type		Saw-timber volume, ^{1/} by State and diameter group				Michigan
		Minnesota	Wisconsin	9.0 to 13.0 inches d.b.h. ^{2/}	13.0 inches and larger d.b.h.	
		M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.	M bd. ft.
White pine	158,350	1,294,460	267,000	776,000	137,000	473,000
Red pine	143,770	616,870	80,000	114,000	36,000	61,000
Jack pine	1,514,500	725,880	170,000	57,000	124,000	47,000
Spruce-fir	601,430	820,410	206,000	132,000	709,000	880,000
Spruce swamp	527,720	73,330	21,000	2,000	131,000	84,000
Tamarack swamp	65,900	10,200	36,000	14,000	35,000	7,000
Cedar swamp	96,870	37,860	56,000	40,000	146,000	151,000
Nonproductive swamp	710	0	0	0	0	0
Northern hard-woods	390,990	947,990	1,760,000	7,163,000	2,754,000	19,293,000
Oak	213,360	313,460	1,099,000	1,850,000	256,000	742,000
Ash-elm	229,500	390,760	386,000	764,000	292,000	917,000
Aspen-birch	1,557,850	1,311,110	662,000	281,000	619,000	398,000
Scrub forest	34,550	62,490	25,000	35,000	1,000	2,000
Deforested	136,140	178,280	221,000	395,000	95,000	159,000
All cover types	5,671,640	6,783,100	4,989,000	11,623,000	5,335,000	23,214,000

^{1/}By International 1/4"-kerf rule.
^{2/}Diameter at breast height.

DIVISION OF SAW TIMBER VOLUME
BETWEEN LARGE AND SMALL TREES
LAKE STATES REGION



IN TREES 13.0 INCHES AND
LARGER IN DIAMETER
AT BREAST HEIGHT



IN TREES 90 INCHES TO
13.0 INCHES IN DIAMETER
AT BREAST HEIGHT

Table 26. -- Volume of saw timber in the Lake States Region, by species and size class

Species	Volume ¹ , by size class of stand				
	All size classes	Old-growth saw timber	Second-growth saw timber	Cordwood	Restocking and deforested
	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.	M bd.ft.
Softwoods					
White pine....	3,753,200	2,203,520	749,070	533,650	266,960
Red pine.....	1,478,380	518,140	475,200	254,000	231,040
Jack pine....	2,677,790	50,390	1,805,100	604,460	217,840
Spruce....	2,362,730	490,750	855,810	879,840	136,330
Balsam-fir....	1,089,310	271,340	408,700	323,740	85,530
Tamarack.....	297,340	18,020	64,140	159,300	55,880
Hemlock.....	9,222,000	8,221,000	665,000	164,000	172,000
All softwoods...	20,880,750	11,773,160	5,023,020	2,918,990	1,165,580
Hardwoods					
Sugar maple...	10,538,120	8,418,670	1,264,530	282,370	572,550
Yellow birch...	5,252,230	3,930,890	759,210	258,630	303,500
Basswood.....	2,039,200	1,263,520	459,160	153,180	163,340
Elm.....	3,178,690	1,662,610	746,440	306,610	463,030
Beech.....	1,496,000	1,132,000	249,000	55,000	60,000
Oak.....	5,297,790	1,840,130	2,090,080	838,390	529,190
Aspen.....	4,125,700	360,690	1,856,560	1,448,540	459,910
Paper birch...	1,288,340	175,220	422,680	525,100	165,340
Soft maple...	1,742,640	1,027,630	408,200	199,430	107,380
Miscellaneous hardwoods ² ...	1,776,280	638,100	641,480	290,910	205,790
All hardwoods..	36,734,990	20,449,460	8,897,340	4,358,160	3,030,030
All species....	57,615,740	32,222,620	13,920,360	7,277,150	4,195,610

¹/ By International 1/4"-kerf rule.

²/ Principally black ash, hickory, and hop-hornbeam.

VOLUME OF SAW TIMBER IN THE LAKE STATES BY SPECIES AND SIZE CLASS OF STAND

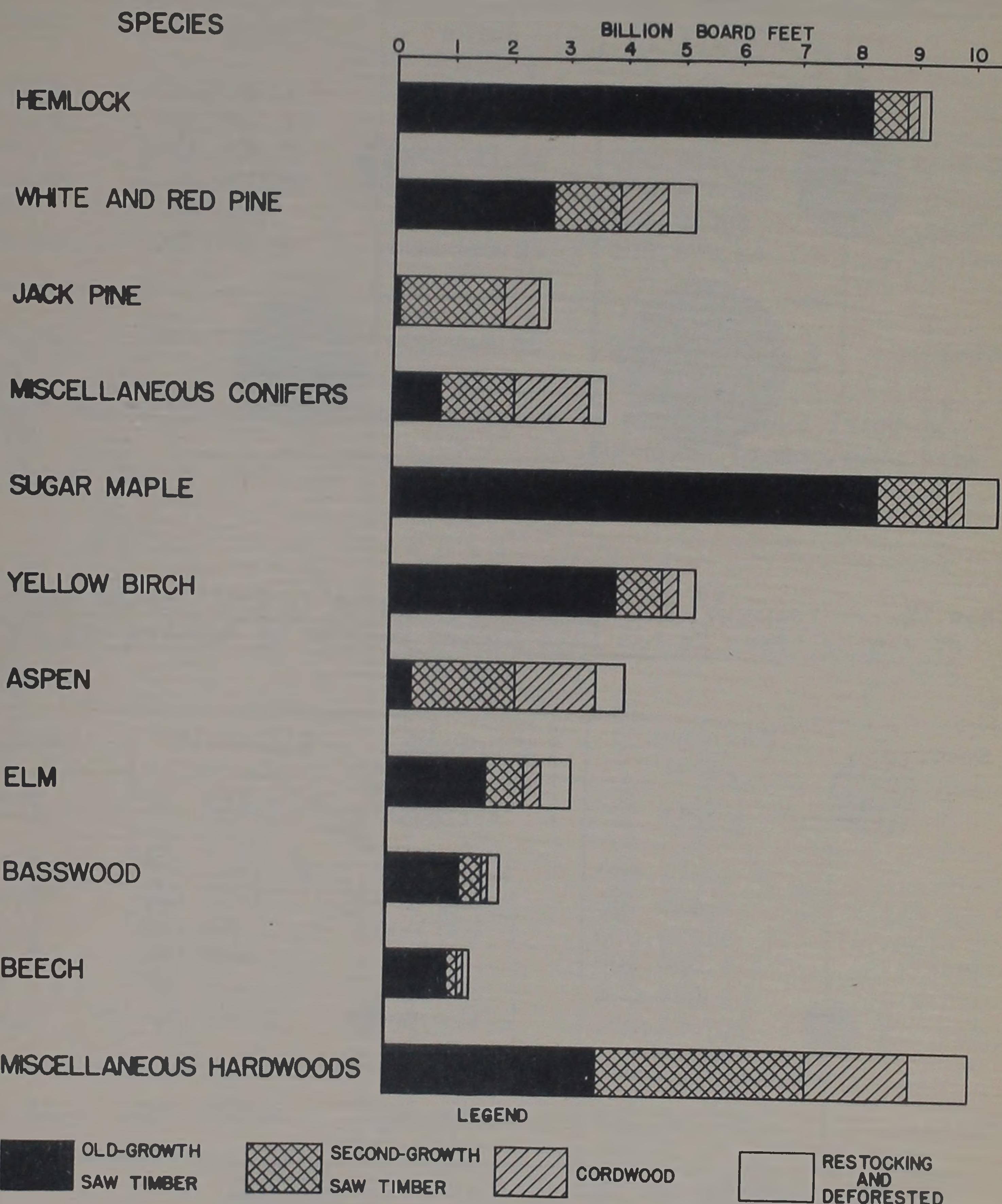


Figure 6

Table 27. -- Total volume^{1/} of pulping species in the Lake States Region

Species	Regional total	Minnesota	Wisconsin	Michigan
	Cords	Cords	Cords	Cords
Spruce.....	16,628,000	10,292,000	1,045,000	5,291,000
Balsam fir..	13,369,000	5,134,000	2,108,000	6,127,000
Jack pine...	17,960,000	13,565,000	2,406,000	1,989,000
Hemlock.....	33,774,000	.....	10,358,000	23,416,000
Tamarack...	3,079,000	1,639,000	648,000	792,000
Aspen.....	43,776,000	22,081,000	9,647,000	12,048,000
 Total.....	 128,586,000	 52,711,000	 26,212,000	 49,663,000

^{1/} Total cubic volume of pulpwood species, including saw timber and some substandard pulpwood.

Table 28. -- Volume^{1/} of high-grade pulpwood in small trees and in tops of sawlog trees in the Lake States Region, by species and State

Species	Regional total	Minnesota	Wisconsin	Michigan
	Cords	Cords	Cords	Cords
Spruce.....	8,811,000	5,429,000	611,000	2,771,000
Balsam fir..	7,435,000	2,551,000	956,000	3,928,000
Jack pine...	8,038,000	5,400,000	1,403,000	1,235,000
Hemlock.....	3,530,000	.....	1,092,000	2,438,000
Tamarack...	1,564,000	644,000	412,000	508,000
Aspen.....	10,062,000	4,216,000	1,609,000	4,237,000
 Total.....	 39,440,000	 18,240,000	 6,083,000	 15,117,000

^{1/} Excludes sawlogs and substandard material.

TOTAL VOLUME OF PULPING SPECIES
IN THE LAKE STATES
THOUSAND CORDS

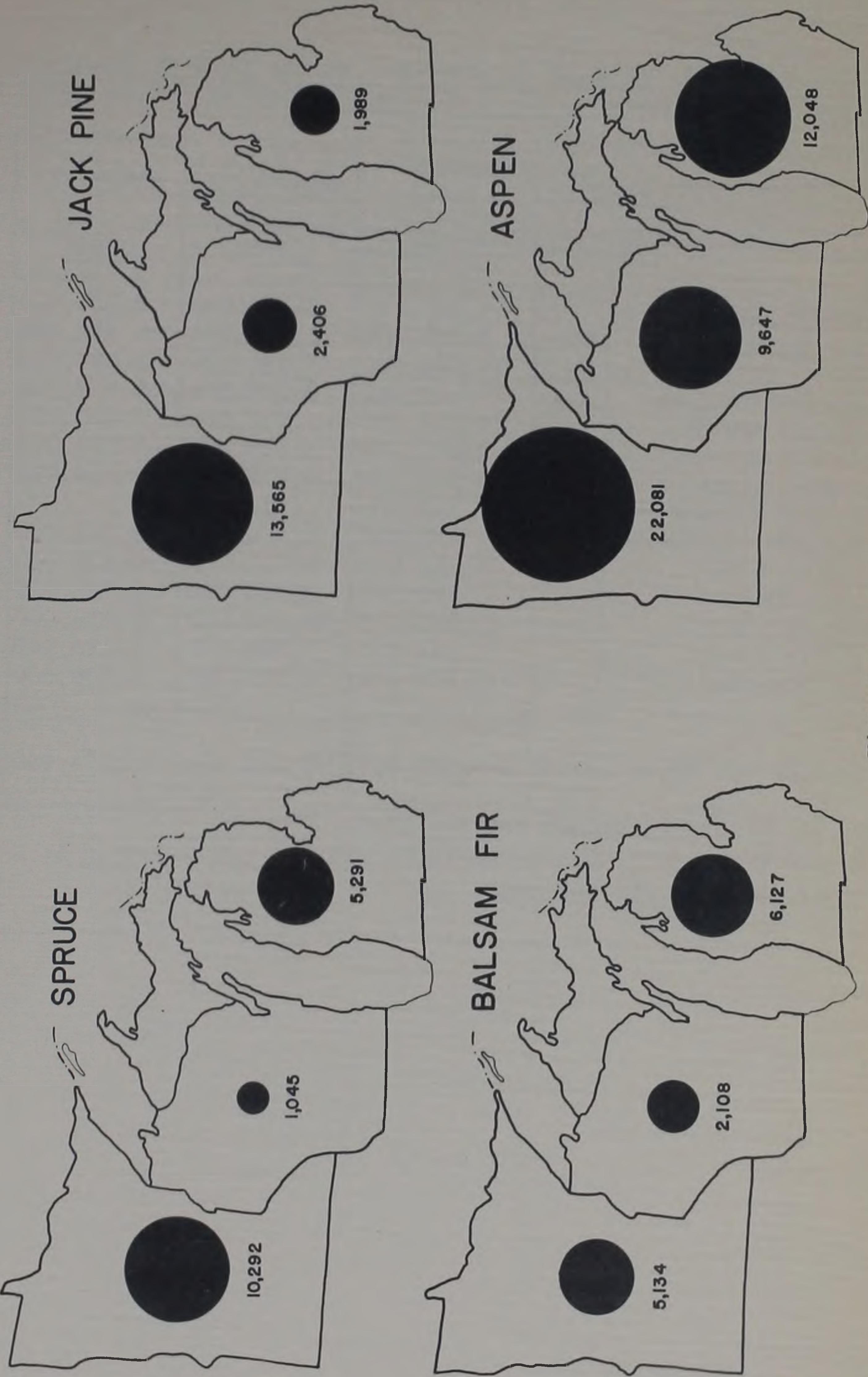


Figure 6

Table 29. -- Volume^{1/} of cordwood in the Lake States Region, by cover type and State

Forest cover type ^{2/}	Regional total	Minnesota	Wisconsin	Michigan
	<u>Cords</u>	<u>Cords</u>	<u>Cords</u>	<u>Cords</u>
White pine.....	6,929,000	3,238,000	2,013,000	1,678,000
Red pine.....	2,301,000	1,407,000	427,000	467,000
Jack pine.....	16,220,000	12,090,000	2,096,000	2,034,000
Spruce-fir.....	21,076,000	8,365,000	3,030,000	9,681,000
Spruce swamp.....	10,231,000	7,912,000	508,000	1,811,000
Tamarack swamp.....	2,047,000	1,118,000	385,000	544,000
Cedar swamp.....	5,443,000	2,219,000	772,000	2,452,000
Nonproductive swamp.....	114,000	114,000	.....	.....
Northern hardwoods.....	102,621,000	8,930,000	29,741,000	63,950,000
Oak.....	26,111,000	4,601,000	15,475,000	6,035,000
Ash-elm.....	18,477,000	5,384,000	6,478,000	6,615,000
Aspen-birch.....	47,943,000	25,863,000	9,819,000	12,261,000
Scrub forest.....	4,054,000	2,826,000	1,124,000	104,000
Deforested.....	11,568,000	4,533,000	4,308,000	2,727,000
All forest types.....	275,135,000	88,600,000	76,176,000	110,359,000

1/ Cedar volumes not included.

2/ Scrub forest in northern half of Lower Peninsula of Michigan is included with the oak type.

Table 30. -- Cedar volume in the Lake States Region, by product and State

Product	Regional total	Minnesota	Wisconsin	Michigan
Round posts..... M pieces	224,774	61,953	49,174	113,647
Split posts..... M pieces	99,715	15,318	25,959	58,438
Poles				
20 feet or less.... M pieces	20,867	8,375	3,226	9,266
25 feet..... M pieces	11,749	1,864	2,598	7,287
30 feet..... M pieces	5,409	592	1,132	3,685
35 feet..... M pieces	2,685	228	507	1,950
40 feet..... M pieces	529	.....	77	452
45 feet..... M pieces	279	.....	49	230
Total poles..... M pieces	41,518	11,059	7,589	22,870
Unmerchantable wood..... M cords	5,256	1,787	788	2,681
Total volume..... M cu.ft.	1,267,750	336,750	240,000	691,000

Table 31. -- Total cubic volume of timber in the Lake States Region, by species and State

Species	Regional total	Minnesota	Wisconsin	Michigan
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Softwoods				
White pine	929,170	352,170	310,000	267,000
Red pine	391,320	231,320	90,000	70,000
Jack pine	1,364,430	1,034,430	181,000	149,000
Spruce	1,285,040	792,040	78,000	415,000
Balsam fir	1,005,490	383,490	157,000	465,000
Tamarack	230,230	121,230	49,000	60,000
Hemlock	2,497,000	.....	766,000	1,731,000
Cedar	1,267,750	336,750	240,000	691,000
All softwoods	8,970,430	3,251,430	1,871,000	3,848,000
Hardwoods ¹				
Sugar maple	3,451,390	121,390	982,000	2,348,000
Yellow birch	1,782,210	33,210	563,000	1,186,000
Basswood	823,640	203,640	353,000	267,000
Elm	1,285,630	282,630	519,000	484,000
Beech	488,000	.....	71,000	417,000
Oaks	2,565,790	439,790	1,490,000	636,000
Aspen	3,135,230	1,588,230	680,000	867,000
Paper birch	941,440	549,440	147,000	245,000
Soft maple	890,530	46,530	259,000	585,000
Miscellaneous hardwoods ²	1,051,180	206,180	446,000	399,000
Scrub trees	423,940	180,940	243,000	.....
All hardwoods	16,838,980	3,651,980	5,753,000	7,434,000
All species	25,809,410	6,903,410	7,624,000	11,282,000

¹ For Michigan the volume of scrub hardwoods is combined with that of oaks.

² Principally black ash, hickory, and hop-hornbeam.

Table 32. -- Quality of hardwood saw timber in the Lake States Region,
by species and State

Species	Percentage of volume in each log grade												
	Regional total			Minnesota			Wisconsin			Michigan			
	No.1	No.2	No.3	No.1	No.2	No.3	No.1	No.2	No.3	No.1	No.2	No.3	
Sugar maple..	26	47	27	21	43	36	16	51	33	30	45	25	
Yellow birch.	36	43	21	4	59	37	31	45	24	39	41	20	
Basswood.....	29	45	26	12	45	43	28	54	18	42	35	23	
Elm.....	27	52	21	16	54	30	26	58	16	35	44	21	
Beech.....	19	50	31	....	....	....	20	41	39	19	51	30
Oak ¹ /.....	16	54	30	5	44	51	16	59	25	23	46	31	
Aspen ² /.....	5	48	47	5	54	41	4	52	44	7	31	62	
Paper birch..	11	48	41	11	45	44	11	53	36	11	50	39	
Soft maple...	13	48	39	5	36	59	15	52	33	14	47	39	
Miscellaneous hardwoods ³ /.	13	49	38	5	39	56	12	56	32	16	46	38	
All hardwoods	22	48	30	8	49	43	19	54	27	28	44	28	

¹/ Includes both red and white oak.

²/ Includes cottonwood and balsam poplar.

³/ Principally black ash, hickory, and hop-hornbeam.

Table 33. -- Average volume of saw timber per acre in the Lake States Region, by cover type and State

Forest cover type	Regional average	Minnesota	Wisconsin	Michigan
	Board feet	Board feet	Board feet	Board feet
White pine.....	5,011	6,217	4,847	3,571
Red pine.....	3,099	4,462	2,262	1,169
Jack pine.....	975	1,770	341	221
Spruce-fir.....	1,064	1,307	530	1,118
Spruce swamp.....	360	393	71	450
Tamarack swamp.....	152	116	246	170
Cedar swamp.....	434	353	484	465
Nonproductive swamp.....	1	1	3	.....
Northern hardwoods.....	3,933	1,498	3,251	4,818
Oak.....	1,271	1,107	1,698	764
Ash-elm.....	1,510	1,007	1,707	1,771
Aspen-birch.....	280	417	177	202
Scrub forest.....	140	179	108	61
Deforested.....	105	76	174	71
All forest types.....	1,036	635	980	1,497

Table 34. -- Average volume¹ of timber per acre in the Lake States Region, by forest cover type and size class

Forest cover type	Volume, by size class								
	All classes			Old-growth saw timber			Second-growth saw timber		
	Bd. ft.	Cu. ft.	Bd. ft.	Cu. ft.	Bd. ft.	Cu. ft.	Bd. ft.	Cu. ft.	Bd. ft.
White pine	5,011	1,510	10,083	2,529	4,435	1,550	1,504	921	127
Red pine	3,099	930	10,972	2,242	5,686	1,514	1,020	719	83
Jack pine	975	527	7,309	1,909	6,045	2,093	540	654	93
Spruce-fir	1,064	632	6,582	2,378	4,054	1,714	936	779	207
Spruce-swamp	360	358	6,643	2,260	3,680	1,589	727	800	70
Tamarack swamp	152	162	4,403	1,397	3,084	1,274	378	506	16
Cedar swamp	434	732	3,175	3,168	1,825	2,303	526	1,095	38
Nonproductive swamp	1	9	0	0	0	0	0	72	244
Northern hard-woods	3,933	1,317	9,950	2,898	3,787	1,575	824	680	191
Oaks	1,271	659	5,089	1,694	3,496	1,534	645	642	108
Ash-elm	1,510	763	5,583	1,908	3,467	1,555	731	679	261
Aspen-birch	280	211	6,086	1,967	3,721	1,498	556	624	179
Scrub forest	140	234	659	896	806	1,084	277	550	51
Deforested	0	0	0	0	0	0	0	0	52
All cover types	1,036	464	8,985	2,650	3,937	1,629	671	688	111
									82

¹/ Board-foot volumes are by International 1/4" kerf rule.

Table 35. -- Average cubic volume of total stand per acre in the Lake States Region, by forest cover type and State

Forest cover type	Regional average	Minnesota	Wisconsin	Michigan
	Cubic feet	Cubic feet	Cubic feet	Cubic feet
White pine.....	1,510	1,733	1,495	1,224
Red pine.....	930	1,166	800	579
Jack pine.....	527	852	279	207
Spruce-fir.....	632	648	449	703
Spruce swamp.....	358	404	127	368
Tamarack swamp.....	162	140	209	184
Cedar swamp.....	732	775	853	668
Nonproductive swamp.....	9	9	2	14
Northern hardwoods.....	1,317	674	1,178	1,526
Oak.....	659	738	831	402
Ash-elm.....	763	522	887	860
Aspen-birch.....	211	270	153	190
Scrub forest.....	234	325	153	144
Deforested.....	61	47	95	43
All forest types.....	464	352	450	591

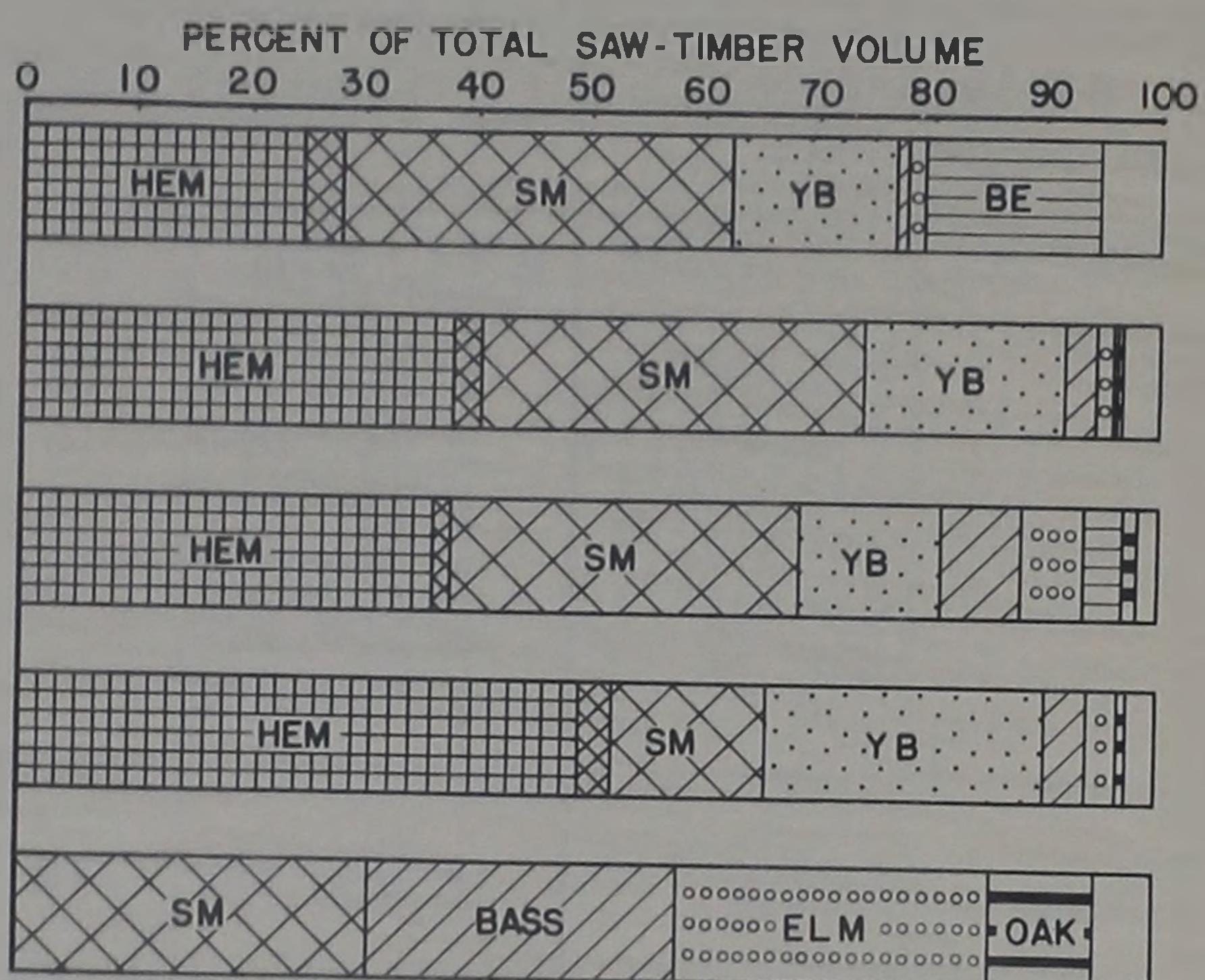
Table 36. -- Average volume¹ of saw timber per acre in old-growth saw-timber stands in the Lake States Region, by forest cover type and State

Forest cover type	Regional average	Minnesota	Wisconsin	Michigan
	Board feet	Board feet	Board feet	Board feet
White pine.....	10,083	11,254	9,877	7,946
Red pine.....	10,972	14,559	5,080	4,285
Jack pine.....	7,309	10,423	3,570	.....
Spruce-fir.....	6,582	8,627	3,887	5,745
Spruce swamp.....	6,643	.....	.....	6,643
Tamarack swamp.....	4,403	.....	4,403	.....
Cedar swamp.....	3,175	3,535	4,180	2,929
Northern hardwoods.....	9,950	5,178	8,416	10,942
Oak.....	5,089	3,184	4,949	6,478
Ash-elm.....	5,583	4,731	5,294	6,151
Aspen-birch.....	6,086	6,138	5,521	6,495
Scrub forest.....	659	.....	659	.....
All forest types.....	8,985	7,924	7,248	10,250

¹ By International 1/4" -kerf rule.

COMPARATIVE COMPOSITION BY SPECIES OF
OLD GROWTH STANDS OF NORTHERN HARDWOODS
IN SEVERAL ECONOMIC UNITS

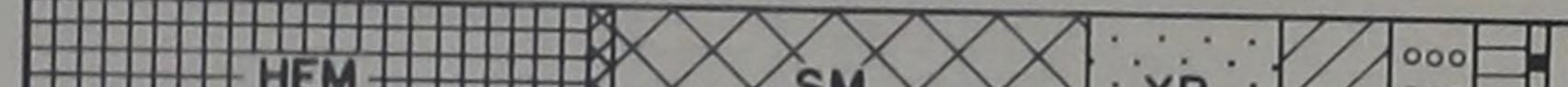
MICHIGAN UNIT 1



MICHIGAN UNIT 2



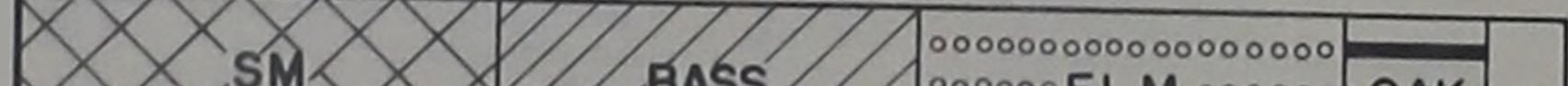
WISCONSIN UNIT 1



WISCONSIN UNIT 2

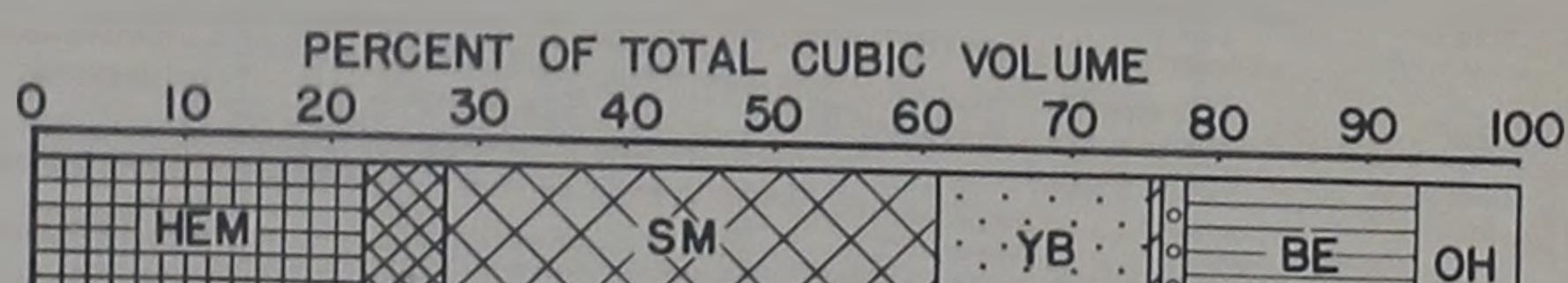


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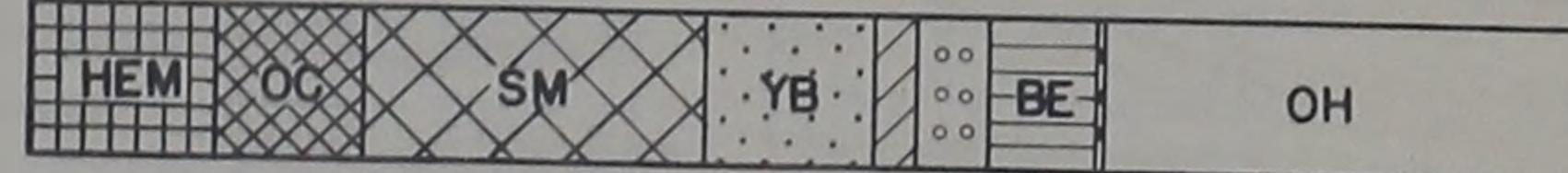


COMPARATIVE COMPOSITION BY SPECIES OF
OLD GROWTH AND CORDWOOD STANDS OF
NORTHERN HARDWOODS IN MICHIGAN AND WISCONSIN
UNIT 1 MICHIGAN

OLD GROWTH



CORDWOOD

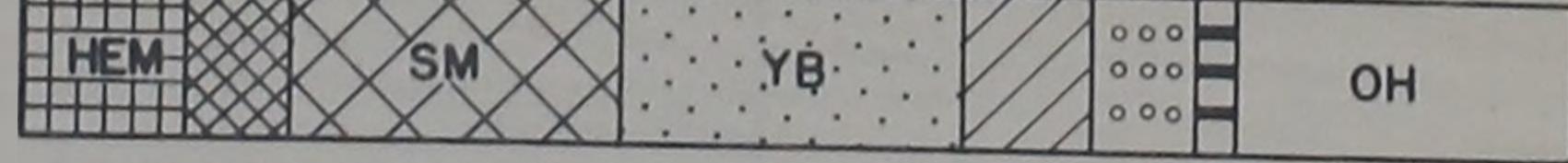


UNIT 2 WISCONSIN

OLD GROWTH



CORDWOOD



HEMLOCK

OTHER CONIFERS

SUGAR MAPLE

YELLOW BIRCH

BASSWOOD

ELM

BEECH

OAK

OTHER HARDWOODS

Figure 8

Table 37. -- Volume of all species in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	High-grade pulpwood	Total volume	
	M ft. b.m.	Cords	Cords	M cu.ft.
Minnesota				
1.....	1,052,210	2,199,000	10,520,599	775,590
2.....	2,941,560	3,773,000	21,869,534	1,611,190
3.....	2,347,130	4,131,000	17,709,133	1,323,570
4.....	4,008,030	7,143,000	23,497,135	1,789,570
5.....	1,525,920	300,000	12,586,199	939,120
6.....	579,890	694,000	6,314,933	464,370
Total.....	12,454,740	18,240,000	92,497,533	6,903,410
Wisconsin				
1.....	5,589,000	1,955,000	29,772,331	2,211,000
2.....	3,683,000	2,652,000	25,298,668	1,871,000
3.....	4,429,000	1,207,000	28,624,999	2,141,000
4.....	2,911,000	269,000	18,689,333	1,401,000
Total.....	16,612,000	6,083,000	102,385,331	7,624,000
Michigan				
1.....	7,724,000	5,315,000	41,262,667	3,088,000
2.....	15,559,000	5,472,000	71,412,999	5,337,000
3.....	2,320,000	3,980,000	22,100,667	1,647,000
4.....	2,946,000	350,000	16,153,333	1,210,000
Total.....	28,549,000	15,117,000	150,929,666	11,282,000
Regional total.....	57,615,740	39,440,000	345,812,530	25,809,410

Table 38. -- Volume of white pine in the Lake States Region, by State and economic unit

State and economic unit	Saw timber		Total volume
	M ft. b.m.	Cords	
Minnesota			
1.....	69,870	280,133	21,010
2.....	468,090	1,291,333	96,850
3.....	568,370	1,516,667	113,750
4.....	463,690	1,495,734	112,180
5.....	13,450	60,533	4,540
6.....	14,730	51,200	3,840
Total.....	1,598,200	4,695,600	352,170
Wisconsin			
1.....	593,000	1,973,333	148,000
2.....	199,000	840,000	63,000
3.....	330,000	1,226,667	92,000
4.....	23,000	93,333	7,000
Total.....	1,145,000	4,133,333	310,000
Michigan			
1.....	269,000	986,667	74,000
2.....	545,000	1,666,666	125,000
3.....	150,000	680,000	51,000
4.....	46,000	226,667	17,000
Total.....	1,010,000	3,560,000	267,000
Regional total.....	3,753,200	12,388,933	929,170

Table 39. -- Volume of red pine in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	Total volume		
		M ft. b.m.	Cords	M cu. ft.
Minnesota				
1	34,660	202,400	15,180	
2	450,160	1,483,467	111,260	
3	293,010	766,800	57,510	
4	208,970	584,667	43,850	
5	7,520	26,800	2,010	
6	4,060	20,133	1,510	
Total	998,380	3,084,267	231,320	
Wisconsin				
1	166,000	653,333	49,000	
2	86,000	386,667	29,000	
3	35,000	133,333	10,000	
4	6,000	26,667	2,000	
Total	293,000	1,200,000	90,000	
Michigan				
1	46,000	320,000	24,000	
2	37,000	120,000	9,000	
3	103,000	493,333	37,000	
4	1,000	0	0	
Total	187,000	933,333	70,000	
Regional total	1,478,380	5,217,600	391,320	

Table 40. -- Volume of jack pine in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	High-grade pulpwood	Total volume	
	M ft. b.m.	Cords	Cords	M cu.ft.
Minnesota				
1.....	144,380	547,000	1,256,000	94,340
2.....	412,510	1,142,000	3,276,000	243,570
3.....	106,720	440,000	926,000	69,950
4.....	1,590,920	3,259,000	8,057,000	622,830
5.....	5,460	2,000	23,000	1,750
6.....	2,800	10,000	27,000	1,990
Total.....	2,262,790	5,400,000	13,565,000	1,034,430
Wisconsin				
1.....	53,000	249,000	443,000	33,000
2.....	101,000	627,000	1,041,000	77,000
3.....	87,000	496,000	865,000	67,000
4.....	5,000	31,000	57,000	4,000
Total.....	246,000	1,403,000	2,406,000	181,000
Michigan				
1.....	29,000	293,000	458,000	34,000
2.....	28,000	74,000	157,000	12,000
3.....	112,000	854,000	1,360,000	102,000
4.....	.....	14,000	14,000	1,000
Total.....	169,000	1,235,000	1,989,000	149,000
Regional total.....	2,677,790	8,038,000	17,960,000	1,364,430

Table 41. -- Volume of hemlock in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	High-grade pulpwood	Total volume	
	M ft. b.m.	Cords	Cords	M cu.ft.
Minnesota				
1				
2				
3				
4				
5				
6				
Total				
Wisconsin				
1	1,406,000	529,000	5,326,000	394,000
2	1,064,000	458,000	4,161,000	308,000
3	202,000	105,000	871,000	64,000
Total	2,672,000	1,092,000	10,358,000	766,000
Michigan				
1	1,529,000	841,000	5,693,000	422,000
2	4,831,000	1,396,000	16,824,000	1,242,000
3	186,000	198,000	885,000	66,000
4	4,000	3,000	14,000	1,000
Total	6,550,000	2,438,000	23,416,000	1,731,000
Regional total	9,222,000	3,530,000	33,774,000	2,497,000

Table 42. -- Volume of spruce in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	High-grade pulpwood	Total volume	
	M ft. b.m.	Cords	Cords	M cu. ft.
Minnesota				
1	100,800	305,000	1,094,000	79,670
2	199,780	398,000	1,165,000	89,070
3	416,280	1,911,000	3,710,000	283,830
4	503,450	2,653,000	4,020,000	316,730
5	720	17,000	38,000	2,740
6	19,700	145,000	265,000	20,000
Total	1,240,730	5,429,000	10,292,000	792,040
Wisconsin				
1	42,000	289,000	444,000	32,000
2	83,000	274,000	515,000	40,000
3	13,000	48,000	86,000	6,000
Total	138,000	611,000	1,045,000	78,000
Michigan				
1	267,000	1,153,000	2,005,000	154,000
2	694,000	1,429,000	3,039,000	242,000
3	23,000	188,000	246,000	19,000
Total	984,000	2,771,000	5,291,000	415,000
Regional total	2,362,730	8,811,000	16,628,000	1,285,040

Table 43. -- Volume of balsam fir in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	High-grade pulpwood	Total volume	
	M ft. b.m.	Cords	Cords	M cu. ft.
Minnesota				
1.....	41,330	751,000	1,194,000	89,650
2.....	116,780	572,000	1,556,000	114,100
3.....	121,130	695,000	1,647,000	121,810
4.....	61,640	484,000	629,000	49,850
5.....	5,150	22,000	47,000	3,540
6.....	4,280	27,000	61,000	4,540
Total.....	350,310	2,551,000	5,134,000	383,490
Wisconsin				
1.....	40,000	357,000	765,000	56,000
2.....	82,000	507,000	1,149,000	86,000
3.....	11,000	92,000	194,000	15,000
Total.....	133,000	956,000	2,108,000	157,000
Michigan				
1.....	272,000	1,641,000	2,637,000	200,000
2.....	298,000	1,924,000	3,003,000	228,000
3.....	36,000	362,000	486,000	37,000
4.....	.....	1,000	1,000	.....
Total.....	606,000	3,928,000	6,127,000	465,000
Regional total.....	1,089,310	7,435,000	13,369,000	1,005,490

Table 44. -- Volume of tamarack in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	High-grade pulpwood	Total volume	
	M ft. b.m.	Cords	Cords	M cu.ft.
Minnesota				
1.....	2,930	4,000	134,000	9,050
2.....	33,140	96,000	423,000	30,340
3.....	77,460	436,000	781,000	59,820
4.....	760	9,000	13,000	960
5.....	16,280	62,000	220,000	15,910
6.....	6,770	37,000	68,000	5,150
Total.....	137,340	644,000	1,639,000	121,230
Wisconsin				
1.....	17,000	103,000	156,000	12,000
2.....	10,000	87,000	122,000	8,000
3.....	55,000	222,000	370,000	29,000
Total.....	82,000	412,000	648,000	49,000
Michigan				
1.....	39,000	295,000	420,000	32,000
2.....	19,000	64,000	129,000	10,000
3.....	15,000	87,000	132,000	10,000
4.....	5,000	62,000	111,000	8,000
Total.....	78,000	508,000	792,000	60,000
Regional total.....	297,340	1,564,000	3,079,000	230,230

Table 45. -- Volume of cedar in the Lake States Region, by State and economic unit

State and economic unit	Total volume	Poles	Posts		Tops and other material
			Round	Split	
Minnesota					
1.....	54,580	727,733	1,820	10,109	3,138
2.....	51,810	690,800	1,633	10,780	2,419
3.....	170,590	2,274,534	5,214	33,397	8,702
4.....	47,810	637,467	2,037	5,113	532
5.....	40	533	4	54	3
6.....	11,920	158,933	351	2,500	524
Total.....	336,750	4,490,000	11,059	61,953	117,920
Wisconsin					
1.....	109,000	1,453,333	3,348	21,548	12,059
2.....	92,000	1,226,667	3,272	16,978	10,889
3.....	39,000	520,000	954	10,541	2,982
4.....	1/	.....	15	107	29
Total.....	240,000	3,200,000	7,589	49,174	25,959
Michigan					
1.....	313,000	4,173,333	9,661	59,627	35,177
2.....	297,000	3,960,000	11,208	31,698	17,634
3.....	77,000	1,026,667	1,939	21,215	5,579
4.....	4,000	53,333	62	1,107	48
Total.....	691,000	9,213,333	22,870	113,647	58,438
Regional total.	1,267,750	16,903,333	41,518	224,774	99,715
					346,920

1/ Less than 1 million cubic feet.

Table 46. -- Volume of sugar maple in the Lake States Region, by State AND economic unit

State and economic unit	Saw timber		Total volume
	M ft. b.m.	Cords	
Minnesota			
1.	30,440	188,267	14,120
2.	56,060	364,533	27,340
3.	70	2,400	180
4.	1/	1/	1/
5.	172,900	837,066	62,780
6.	46,650	226,267	16,970
Total.	306,120	1,618,533	121,390
Wisconsin			
1.	1,324,000	5,666,666	425,000
2.	452,000	2,546,667	191,000
3.	779,000	3,573,333	268,000
4.	254,000	1,306,667	98,000
Total.	2,809,000	13,093,333	982,000
Michigan			
1.	2,061,000	7,946,667	596,000
2.	4,671,000	19,746,667	1,481,000
3.	427,000	2,360,000	177,000
4.	264,000	1,253,333	94,000
Total.	7,423,000	31,306,667	2,348,000
Regional total.	10,538,120	46,018,533	3,451,390

^{1/} Sugar maple in this unit is of inferior quality and is included with soft maple, in table 54.

Table 47. -- Volume of yellow birch in the Lake States Region, by State and economic unit

State and economic unit	Saw timber		Total volume
	M ft. b.m.	Cords	
Minnesota	85,580	386,933	29,020
	6,240	41,600	3,120
	340	2,800	210
	0	0	0
	900	9,600	720
	170	1,867	140
Total	93,230	442,800	33,210
Wisconsin	584,000	3,026,667	227,000
	689,000	3,626,667	272,000
	110,000	813,333	61,000
	5,000	40,000	3,000
	1,388,000	7,506,667	563,000
Michigan	1,046,000	4,160,000	312,000
	2,678,000	11,280,000	846,000
	43,000	293,333	22,000
	4,000	80,000	6,000
	3,771,000	15,813,333	1,186,000
Regional total	5,252,230	23,762,800	1,782,210

Table 48. -- Volume of basswood in the Lake States Region, by State and economic unit

State and economic unit	Saw timber		Total volume
	M ft. b.m.	Cords	
Minnesota			
1	20,080	143,867	10,790
2	116,230	764,400	57,330
3	10,540	48,400	3,630
4			
5	242,640	1,371,866	102,890
6	61,710	386,667	29,000
Total	451,200	2,715,200	203,640
Wisconsin			
1	278,000	1,373,333	103,000
2	127,000	880,000	66,000
3	262,000	1,533,334	115,000
4	161,000	920,000	69,000
Total	828,000	4,706,667	353,000
Michigan			
1	66,000	293,333	22,000
2	385,000	1,573,333	118,000
3	110,000	826,667	62,000
4	199,000	866,667	65,000
Total	760,000	3,560,000	267,000
Regional total	2,039,200	10,981,867	823,640

Table 49. -- Volume of elm in the Lake States Region, by State and economic unit

State and economic unit	Saw timber		Total volume	
	M ft. b.m.	Cords	M cu. ft.	
Minnesota				
1	23,150	124,667	9,350	
2	127,070	719,333	53,950	
3	72,230	386,000	28,950	
4				
5	321,960	1,636,400	122,730	
6	157,280	902,000	67,650	
Total	701,690	3,768,400	282,630	
Wisconsin				
1	320,000	1,706,667	128,000	
2	160,000	1,000,000	75,000	
3	562,000	3,106,666	233,000	
4	187,000	1,106,667	83,000	
Total	1,229,000	6,920,000	519,000	
Michigan				
1	150,000	666,667	50,000	
2	286,000	1,026,666	77,000	
3	242,000	1,840,000	138,000	
4	570,000	2,920,000	219,000	
Total	1,248,000	6,453,333	484,000	
Regional total	3,178,690	17,141,733	1,285,630	

Table 50. -- Volume of beech in the Lake States Region, by State and economic unit

State and economic unit	Saw timber		Total volume
	M ft. b.m.	Cords	
Minnesota			
1.....			
2.....			
3.....			
4.....			
5.....			
6.....			
Total.....			
Wisconsin			
1.....	129,000	666,667	50,000
2.....			
3.....	41,000	280,000	21,000
4.....			
Total.....	170,000	946,667	71,000
Michigan			
1.....	948,000	3,760,000	282,000
2.....	17,000	80,000	6,000
3.....	260,000	1,160,000	87,000
4.....	101,000	560,000	42,000
Total.....	1,326,000	5,560,000	417,000
Regional total.....	1,496,000	6,506,667	488,000

Table 51. -- Volume of oaks in the Lake States Region, by State and economic unit

State and economic unit	Saw timber		Total volume
	M ft. b.m.	Cords	
Minnesota			
1.....	7,440	47,333	3,550
2.....	75,570	553,734	41,530
3.....	2,270	8,133	610
4.....	.....	.....	.....
5.....	495,440	3,785,467	283,910
6.....	181,070	1,469,200	110,190
Total.....	761,790	5,863,867	439,790
Wisconsin			
1.....	135,000	653,333	49,000
2.....	89,000	586,667	44,000
3.....	1,238,000	7,600,000	570,000
4.....	1,863,000	11,026,666	827,000
Total.....	3,325,000	19,866,666	1,490,000
Michigan ^{1/}			
1.....	4,000	53,333	4,000
2.....	58,000	306,667	23,000
3.....	167,000	2,946,667	221,000
4.....	982,000	5,173,333	388,000
Total.....	1,211,000	8,480,000	636,000
Regional total.....	5,297,790	34,210,533	2,565,790

^{1/} Cubic-foot and cordwood values include volume of scrub trees.

Table 52. -- Volume of aspen in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	High-grade pulpwood	Total volume	
	M ft. b.m.	Cords	Cords	M cu. ft.
Minnesota				
1	263,070	592,000	2,929,000	209,360
2	681,180	1,565,000	7,407,000	530,920
3	534,100	649,000	3,997,000	289,550
4	773,070	738,000	4,880,000	356,840
5	77,330	197,000	1,025,000	72,690
6	37,950	475,000	1,843,000	128,870
Total	2,366,700	4,216,000	22,081,000	1,588,230
Wisconsin				
1	191,000	428,000	2,665,000	186,000
2	251,000	699,000	4,244,000	297,000
3	203,000	244,000	1,799,000	127,000
4	159,000	238,000	939,000	70,000
Total	804,000	1,609,000	9,647,000	680,000
Michigan				
1	384,000	1,092,000	3,263,000	237,000
2	166,000	585,000	2,701,000	186,000
3	284,000	2,291,000	5,205,000	379,000
4	121,000	269,000	879,000	65,000
Total	955,000	4,237,000	12,048,000	867,000
Regional total	4,125,700	10,062,000	43,776,000	3,135,230

Table 53. -- Volume of paper birch in the Lake States Region, by State and economic unit

State and economic unit	Saw timber		Total volume
	M ft. b.m.	Cords	
Minnesota			
1.....	168,670	1,306,266	97,970
2.....	125,990	1,297,867	97,340
3.....	113,820	1,315,333	98,650
4.....	353,140	3,009,600	225,720
5.....	13,960	282,267	21,170
6.....	7,760	114,533	8,590
Total.....	783,340	7,325,866	549,440
Wisconsin			
1.....	78,000	826,666	62,000
2.....	43,000	560,000	42,000
3.....	18,000	346,667	26,000
4.....	21,000	226,667	17,000
Total.....	160,000	1,960,000	147,000
Michigan			
1.....	201,000	1,600,000	120,000
2.....	89,000	946,667	71,000
3.....	53,000	666,667	50,000
4.....	2,000	53,333	4,000
Total.....	345,000	3,266,667	245,000
Regional total.....	1,288,340	12,552,533	941,440

Table 54. -- Volume of soft maple in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	Total volume	
	M ft. b.m.	Cords	M cu.ft.
Minnesota			
1.....	8,340	59,467	4,460
2.....	3,960	55,200	4,140
3.....	2,410	26,133	1,960
4.....	51,510	164,667	12,350
5.....	35,290	238,000	17,850
6.....	9,130	76,933	5,770
Total.....	110,640	620,400	46,530
Wisconsin			
1.....	116,000	893,333	67,000
2.....	99,000	853,333	64,000
3.....	161,000	1,253,333	94,000
4.....	59,000	453,333	34,000
Total.....	435,000	3,453,332	259,000
Michigan			
1.....	337,000	2,146,667	161,000
2.....	508,000	3,173,333	238,000
3.....	59,000	813,333	61,000
4.....	293,000	1,666,667	125,000
Total.....	1,197,000	7,800,000	585,000
Regional total.....	1,742,640	11,873,732	890,530

Table 55. -- Volume of Miscellaneous Hardwoods in the Lake States Region,
by State and economic unit

State and economic unit	Saw timber	Total volume		
		M ft. b.m.	Cords	M cu. ft.
Minnesota				
1.....	51,470	441,200	33,090	
2.....	68,800	726,800	54,510	
3.....	28,380	296,000	22,200	
4.....	880	6,000	450	
5.....	116,920	1,008,934	75,670	
6.....	25,830	270,133	20,260	
Total.....	292,280	2,749,067	206,180	
Wisconsin				
1.....	117,000	1,026,667	77,000	
2.....	148,000	1,320,000	99,000	
3.....	322,000	2,386,666	179,000	
4.....	168,000	1,213,333	91,000	
Total.....	755,000	5,946,666	446,000	
Michigan				
1.....	76,000	680,000	51,000	
2.....	249,000	1,680,000	126,000	
3.....	50,000	680,000	51,000	
4.....	354,000	2,280,000	171,000	
Total.....	729,000	5,320,000	399,000	
Regional total.....	1,776,280	14,015,733	1,051,180	

^{1/} Principally black ash, hickory, and hop-hornbeam.

Table 56. -- Volume of scrub trees in the Lake States Region, by State and economic unit

State and economic unit	Saw timber	Total volume	
	M ft. b.m.	Cords	M cu. ft.
Minnesota			
1.		5,333	400
2.		53,467	4,010
3.		4,933	370
4.		1/	1/
5.		1,975,733	148,180
6.		373,067	27,980
Total.		2,412,533	180,940
Wisconsin			
1.		53,333	4,000
2.		240,000	18,000
3.		1,666,667	125,000
4.		1,280,000	96,000
Total.		3,240,000	243,000
Michigan ^{2/}			
1.			
2.			
3.			
4.			
Total.			
Regional total.		5,652,533	423,940

^{1/} All scrub trees in this unit have been considered cull.

^{2/} Volume of scrub trees in Michigan is combined with that of "oaks," in table 51.

DEFINITIONS AND NOTES

Economic Units

Forest Survey data were assembled by "economic units," each of which has more or less distinctive economic features or forest conditions. The boundaries of these units, which are numbered serially in each State, are shown in figure 1.

Volume Classification

Units of Measure

All volume estimates include living trees only. Timber volumes were computed in terms of total tree volume and in terms of various special forest products. Volumes are expressed in board feet, cubic feet, cords or number of pieces. Board-foot volumes are by the International 1/4"-kerf log rule except where otherwise specified. (The International rule closely approximates green lumber tally.) Cords are standard 4'x4'x8' cords of un-peeled wood. Cubic-foot volumes do not include bark.

Saw Timber

Board-foot volume was computed for all trees 9 to 17 inches in diameter at breast height having at least a 10-foot log of good quality or a 16-foot log of poor quality, and for all trees larger than 17 inches having at least one 16-foot log of good quality or two 16-foot logs of poor quality.

Minimum top diameters were 6 inches in softwood species and aspen, 8 inches in hardwoods. For most trees the top diameter was considerably greater than 8 inches, because the limit of merchantability was determined by branches, forks, etc., rather than by diameter. A large proportion of the small-size logs of pulpwood species were estimated as pulpwood rather than sawlogs.

Cedar was estimated in terms of piece products, and hence is not included with saw timber.

Allowance was made for defect, decay, sweep, and other shrinkage, so that the recorded board-foot volumes are the net merchantable volumes.

High-grade Pulpwood

Only species commonly used for pulpwood in the Lake States were included in the pulpwood estimates. These are spruces, balsam fir, jack pine, hemlock, tamarack, and aspen. No wood in trees less than 5 inches in diameter at breast height was consid-

ered merchantable. No good saw timber was classified as pulpwood, although many of the smaller sawlogs of these species are suitable for pulpwood and probably will be so used.

The pulpwood volume included wood in trees below saw-timber size from which at least two 8-foot sticks could be cut and in tops of sawlog trees from which one 8-foot stick could be cut.

In the case of aspen and hemlock, no wood smaller than 5 inches inside bark was estimated as pulpwood. For other species the minimum diameter was 4 inches.

Cedar Products

Cedar was estimated in terms of numbers of poles and posts. The standards for cedar poles conform to the specifications of the Northern White Cedar Association; lengths range from 16 feet to 45 feet, and minimum and maximum top diameters vary with length of pole over the range from 4-1/2 inches to 9 inches.

Cedar posts are 7 feet long, with a minimum top diameter of 4 inches.

The material estimated as split cedar posts included all wood 4 inches and larger in diameter which was unsuitable for either poles or round posts. Some of this volume is usable for dimension stock, shingle stock, ties, and sawed miscellaneous products. A large proportion, however, is usable only for lagging

or other split products.

Cedar trees which could produce at least a 16-foot pole, 2 posts, 14 lineal feet of reasonable straight splitting material, or a tie-cut, were tallied as sound trees. Those too crooked or rotten to meet these qualifications were culled.

Total Cubic Feet

Total cubic-foot volume included all wood, exclusive of bark, which lay between the stump and a top diameter of 4 inches inside bark. In hardwoods, limbwood larger than 4 inches as well as the main stem was included. The cubic volume of cull trees was excluded from the volume estimates, except where explicitly pointed out in the tables.

Tops and Limbs

Tops and limbs included the volume of wood 4 inches or larger in diameter inside bark lying above sawlogs in saw-timber trees. In conifers this class included only topwood in the main stem; in hardwoods, both topwood and limbwood.

A part of the topwood in conifers is suitable for high-grade pulpwood. This fraction was included both in high-grade pulpwood volumes and in volumes of tops and limbs.

Small Trees

Small trees are those which have a diameter at breast height of at least 5.0 inches but are too small to produce a sawlog of minimum size. All 6- and 8-inch trees were grouped under this heading, and all trees 9 to 12 inches in diameter which did not contain a sawlog of minimum size. Pulpwood volume in such trees was included both in pulpwood volumes and in volumes of small trees.

Cull in Sawlog Trees

Cull in sawlog trees included the volume which is deducted in the woods in the form of short sections or logs because of rot, crook, fork, shake, and other defects, and that which has to be deducted in the mill for defects in merchantable logs.

Cull Trees

Cull trees are those which do not contain the minimum merchantable volume specified above in the definitions of saw timber, pulpwood, and piece products, and which, because of rot, can never attain merchantability.

Log Quality

Log quality is expressed in three grades:

No. 1 Logs must be at least 12 feet long and 12 inches in

diameter inside bark at the small end. The following defects are allowed, the variation depending on log diameter: Up to three standard defects or sound bright knots, each with a diameter of not more than 3 inches or its equivalent in damage to the product of the log; up to 20 percent deduction from the gross scale for rot or similar defects. No. 1 logs must saw out 60 percent or more of No. 1 common or better lumber.

No. 2 Logs must generally be at least 10 feet long and 8 inches in diameter inside bark at the small end. They include, however, the better-quality 8-foot logs, 10 or more inches in diameter; but these -- and likewise all longer logs less than 10 inches in diameter -- must be surface clear, straight, and sound. Larger logs are permitted up to three standard defects. No. 2 logs must cut out 75 percent sound lumber, of which 30 percent must be No. 1 common or better.

No. 3 Logs include all logs suitable for ties, timbers, or low-grade lumber. For most species the minimum size requirements are 8-foot length and 8-inch diameter. These logs will generally cut out 50 percent sound.

Area Classification

Forest areas were classified as to the character of the forest cover and condition of the timber stand. All unimproved

lands in the forest region except marshes, open bogs, unsurveyed waters, barrens, rock outcrops, and beaches were considered forest land, whether supporting forest growth or entirely deforested.

Size Classes

Saw Timber. -- Any stand which had 2,000 board feet or more of saw timber per acre was classified as a saw-timber stand. If 50 percent or more of the volume occurred in trees over 15 inches in diameter at breast height, the stand was classified as Old-Growth Saw Timber; if more than 50 percent of the sawlog volume occurred in trees less than 15 inches in diameter at breast height, the stand was rated Second-Growth Saw Timber.

Cordwood. -- A stand containing less than 2,000 board feet of saw timber per acre but having 3 cords or more per acre of trees below sawlog size was classified as a Cordwood stand.

Reproduction. -- If there were less than 3 cords of cordwood trees and less than 2,000 board feet of saw timber per acre, the stand was rated as Reproduction, provided that at least 10 percent of the available growing space was occupied by small trees of commercial species.

Deforested. -- Forest lands which had at some time been timbered but which qualified for none of the condition classes defined above were rated as Deforested.

Forest Cover Types

Stands were classified into forest cover types according to the predominance^{4/} of a key species or group of species. The white pine cover type, for example, includes stands consisting 50 percent or more of this species. "Mixed" cover types, such as spruce-fir and aspen-birch, are characterized by the predominance, collectively, of the group of indicator species. As might be expected, mixed types vary considerably as to proportions of individual species in the several subdivisions of the region. The principal types were defined as follows:

Jack pine, Red pine, and White pine. -- The types in which these species, respectively, predominate.

Northern Hardwoods, or Hemlock-Hardwood. -- This is a "mixed" type in which the principal species are sugar maple, hemlock, yellow birch, basswood, and beech. Associated species which occur in lesser proportions are northern white pine, red oak, balsam fir, hop-hornbeam, elm, and cedar. The type varies in composition from a mixture of all species to almost pure stands of any one of the

^{4/} The term "predominant," as used in these definitions, means composing 50 percent or more of the total volume in cordwood and saw-timber stands or more than 50 percent of the unsuppressed trees in reproduction stands. A stand in which no single species or group of species clearly predominates is classified according to the more valuable species present.

key species. Pure stands of hemlock are considered a variation of this type.

Oak, or Central Hardwoods. -- This is a mixed type characterized by white, red, and bur oaks in association with maple, basswood, and other hardwoods. It is typical of the Central States but is common in the southern portion only of the Lake States.

Scrub forest. -- Stands of any species or group which are of such poor form as to be totally unmerchantable except for fuel wood and to show no promise of becoming merchantable.

Aspen-Birch. -- Aspen and paper birch, either singly or together, make up more than 50 percent of the stand.

Ash-Elm. -- Occurs in shallow swamps, overflow lands, or "second bottoms." The characteristic species of this type are black ash, American elm, and soft maples. Associates in the swamps of the northern part of the Lake States include balsam poplar, yellow birch, green ash, cedar, hemlock, spruce, and occasional other hardwoods. On the alluvial bottoms in the southern part of the region the associated species are black walnut, butternut, willow, hackberry, balsam poplar, river birch, and swamp white oak.

Spruce-Fir. -- This type is typically a mixture of white spruce, balsam fir, northern white cedar, paper birch, aspen, black ash, and sometimes yellow birch, hemlock, or pine. It occurs on cool moist uplands, or along swamp borders.

Spruce Swamp. -- This type is closely confined to acid peat bogs with poor drainage and is thus distinguished from the spruce-fir type, which grows on upland soils. Black spruce occurs in pure stands or mixed with balsam fir, tamarack, and cedar.

Tamarack Swamp. -- This type is very similar to the spruce swamp type in characteristic associates and site, but tamarack predominates.

Cedar Swamp. -- This type occurs on shallow peat having fair drainage. Common associates of the cedar are swamp species including spruce, balsam fir, tamarack, and paper birch; frequent associates include yellow birch, black ash, red maple, and northern white pine. (A mixture of cedar and other conifers on upland sites is classified under the spruce-fir type.)

Nonproductive Swamp. -- Scrubby spruce or tamarack on deep, poorly drained peat, usually less than 5 inches in d.b.h. at 100 years of age. This type does not include deforested but potentially productive peat land.

Species

Although timber volumes are presented separately for most species, some of the less common hardwood species are grouped.

Miscellaneous hardwoods include ash (principally black ash), hickory, hop-hornbeam, willow, butternut, black walnut, black cherry, and black locust.

hackberry, yellow poplar, sycamore, and black locust. All species of elm have likewise been grouped, and also the several species of oak. Poplar includes aspen, largetooth aspen, balsam poplar, and eastern cottonwood.

Blue beech, pin cherry, witch-hazel, alder, mountain maple, and crab apple, all more or less shrubby in character, have been excluded from the volume estimates.

In the Lake States Region the species designated red pine in this report is commonly known as Norway pine, that designated hop-hornbeam is commonly known as ironwood, and that designated pin cherry is commonly known also as red or fire cherry.

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